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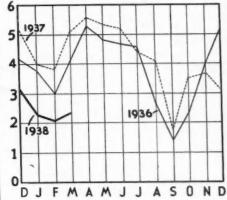
AUTOMOTIVE PRODUCTION*

Passenger Cars and Trucks -U.S. and Canada

Bar charts at the right represent total production to March 31st of year indicated.

Numbers at left of monthly graph below show production in 100,000°s.

★ From Department of Commerce Report and Automobile Manufacturers' Ass'n.



108 1.302. MAR. 919 3 665, MAR. 9 10 1937 MAR. 1936 2

Ideas in Zinc

Every design change in the automotive industry means a re-investigation of available materials and methods of fabrication. Take, for example, the trend toward the elimination of running boards as typified by the Cadillac "60" Special.

The adoption of this feature will involve more than the mere doing away of the running boards. It means that the car stylist must originate some type of decorative molding to finish off the lengthy lower line of the body. This will bring many materials, new and old, up for consideration—and prominent among these will be zinc alloy die castings.

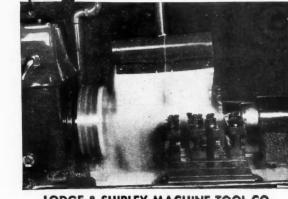
Zinc alloy is the least expensive of the non-rusting metals. The molding, because of its location, will be subjected to considerable road splashing—an enemy of plated coatings. Zinc alloy die castings are easily and durably plated—able to take this punishment. Also, these moldings can be fabricated in any required sections and shapes.

Design engineers will do well to investigate zinc alloy die castings for this application. The New Jersey Zinc Company, 160 Front Street, New York City.

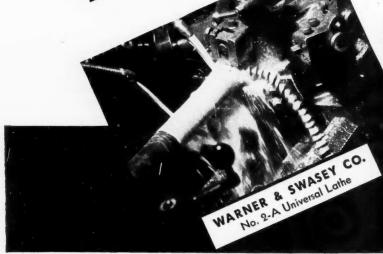
Idea No. 12

PROVED and APPROVED

by the



LODGE & SHIPLEY MACHINE TOOL CO.
No. 5 Duomatic Lathe





April 16, 1938

Vol. 78, No. 16

AUTOMOTIVE

Labor

Federal Truce Ends Peacefully With New Contract Signed

As contracts entered into between manufacturers and labor unions a year ago continue to come up for renewal during the current period, the Detroit area has been hearing echoes recalling last year's turbulent labor situations.

Although there have been impasses, threatened flare-ups and even a few outbursts of violence in the past few weeks negotiations have, in most instances, been compléted satisfactorily or are being continued with a fair amount of equanimity.

The latest incident in the constantly active situation was the closing of Briggs Manufacturing Company's Mack avenue plant in Detroit on April 11 by company officials after they had charged union members with engaging in a slow-down strike in the cushion department which affected production in the entire body plant. Because of the shutdown and resultant shortage of bodies the Plymouth division of the Chrysler Corp. also was obliged to shut down for the day.

Union officials denied a slow-down and claimed instead the men were resisting a speed-up. The incident occurred while representatives of United Automobile Workers were negotiating in the plant with company officials for a renewal of the contract which expires on April 17 and affected 8100 men in the Briggs plant and between 5000 and 6000 men at Plymouth. Company officials announced settlement of the dispute as follows:

"At a conference between the company and the men it was agreed that operations will be resumed. The men agreed to supply the production requested in the cushion department which was the only department affected, as it could not be proven that there was any evidence of speedup in this department. However, the company agreed to consider any further evidence that the union might sub-



RICHARD V. RHODE

. . . engineer with the National Advisory Committee on Aeronautics, Langley Field, Va., was awarded the 1937 Wright Brothers

Va., was awarded the 1937 Wright Brothers Medal by the Society of Automotive Engineers at the Metropolitan Section's meeting on April 12.

The Wright Brothers award, given annually by the SAE, is awarded for the best technical paper on aerodynamics, structural theory, or research for airplane design or construction. Mr. Rhode won the medal for his paper "Gust Loads on Airplanes," which was given at the SAE meeting in Detroit, Jan. 14.

mit with respect to this complaint."

Negotiations between Hudson Motor Car Co. and the UAW had not been completed when their former contract expired on April 8 and union employes were technically without a contract as they worked this week. Company officials report that negotiations were being continued but in the meantime the Hudson local has petitioned the National Labor Relations Board to certify the union as the sole bargaining agency for all Hudson employes, including office workers. Continued negotiations will determine whether the former contract will be renewed, as

(Continued on page 534)

Production

Little Change in Pace Since First of Month

Gains noted a week ago in factory production of passenger cars and trucks were maintained during the week ending April 16 with the result that the industry will finish the second week of the month with an estimated output just about equal to that of the previous week. Most factories maintained the pace established at the beginning of the month with slight increases on the part of several manufacturers offset by modifications in the schedules of others.

In the General Motors group, Buick showed a slight improvement with about 3400 units scheduled for the week. Other GM units showed little or no change to bring total production for the week to about 21,775 cars and trucks.

Chrysler divisions also maintained the pace in effect a week ago, although it is estimated that total production will be off a little for the week because the Plymouth division lost part of a day when it was closed as a result of the one day Briggs shutdown.

Ford, it is estimated, will also finish the week on a par with the output of close to 15,000 units established a week ago, while Hudson expected an improvement of about 125 units to bring its production total for the week to around 1175 cars. Willys also was up a little with 700 units scheduled and other independents continued on the levels previously established.

With the week's total production estimated at 58,000 cars and trucks, production for April to date will total close to 120,000, and the total for the month probably will be in the neighborhood of 240,000 unitswhich would mean a slight increase over March.

Factories report that sales of both new and used cars have responded to seasonal influences although not in the degree that would have been

(Continued on page 531)



Acme Photo

SCHOOL While Britain's rearmament and recruiting program is proceeding rapidly a little-known corps, composed entirely of women, is preparing for any national emergency. The corps, known as the

Women's Transport Service, has a membership of 500. It is supported in peace time by voluntary contributions with army instructors providing training at weekly classes. Above, a class is receiving instructions in engine mechanics.

Automotive News from Tokyo

Japanese Parliament Meets With Criticism of Structural Fitness of Domestic Cars

It has been reported to AUTOMO-TIVE INDUSTRIES that criticism of motor cars of Japanese make was running high in the Imperial Diet now in session. Several interpolators rose from their seats to ask if the Japanese Government was aware that Japanese cars were quite unfit to stand up under severe service conditions such as imposed on them on the China fronts. Faced with a frown from War Minister General Sugiyama, Commerce Minister Yoshino took the rostrum to explain that the government is doing its best to bring Japanese cars up to the standards of foreign makes.

A director of the Toyota Automobile Co., on his return from an inspection trip to China, pointed out that unfitness of structural materials, particularly special steel products, is responsible for the failure of Japanese vehicles.

The Toyota firm announced that it has completed research on a new high-powered truck model which will be put into production shortly. The new truck will stand up under the severest conditions, the firm confidently predicts.

Parts Production Active

The Department of Commerce and Industry is encouraging the Tokyo Automobile Dealers' Association and Tokyo Motor Machine Industry Guild, which are planning to merge into a motorcar parts export union, to execute the scheme in keeping

with approved export policy methods and to make provisions for strict conditioning of the export materials.

The organizing committee has also sent invitations to the Nagoya motorcar parts exporters and the Osaka Automobile Parts Industry Guild to join in the project.

It is further learned that T. Ishii, president of the Ishii Iron Works is (Turn to page 533, please)



JANS R. DUNSFORD has been elected president of the Wilson Foundry & Machine Co. He succeeds CHARLES E. WILSON who continues as a member of the board of directors.

Magnus Chemical Co. announces the appointment of three resident sales representatives; ALFRED L. GOUGH for the state of Rhode Island, JAMES J. O'KEEFE for the state of Virginia and LINWOOD D. KNIGHT for the state of New Hampshire.

FOREST H. AKERS and FRANK TIM-MENS have been appointed as assistant general sales managers for the Dodge Division of Chrysler Corp.

EDWARD HEDNER has been advanced to the posi ion of director of the service and mechanical department of Chevrolet. J. S. CLARK succeeds Mr. Hedner as assistant advertising manager.

ALFRED C. HOWARD has been made general manager of Fairbanks, Morse & Co. CHARLES H. MORSE, III, has been appointed assistant to Mr. Howard.

MAX W. BABB, president of the Allis-Chalmers Mfg. Co., has been elected a director of Cutler-Hammer, Inc., to succeed T. JOHNSON WARD who has retired.

PRESCOTT C. RITCHIE, advertising manager of the Waukesha Motor Co., has been elected president of the Waukesha Association of Commerce.

Perfect Circle Annual Report

The Perfect Circle Co. showed a net profit for 1937 of \$586,367.26 in its recently released annual report. Surplus for December 31, 1937, was given as \$1,623,096.07.

Pierce-Arrow Ruled Insolvent

Order Brings End to One of Country's Oldest Auto Firms

Federal Judge John Knight has ruled the Pierce-Arrow Motor Corp. insolvent and directed liquidation of the Buffalo firm. The order was made at the request of William I. Morey, attorney for trustees in reorganization of the company. Previous to Mr. Morey's report, Martin C. Ewald, a trustee and secretary-treasurer of the company, made the following estimate of assets and liabilities:

Total assets have a book value of \$2,768,822 and a realizable value of \$1,197,771. Against this are total liabilities of \$1,892,745. Mr. Ewald said there would be no dividends or reimbursements for stockholders or general creditors. The Marine Trust Co. of Buffalo, the New York Federal Reserve Bank and Walter Schott of Cincinnati are the only creditors who will collect.

The Marine Trust and Federal

Reserve Bank had due them a total of \$1,317,000 of which it is estimated they will suffer a deficit of \$458,580 after payments are made by the company. They hold a mortgage on the land and equipment, excluding inventories, of \$1,317,000.

Inventories of the company are secured by notes issued to Mr. Schott, amounting to \$80,170. "It is doubtful if the sale will pay the loan in full," Mr. Ewald said. Pierce-Arrow issued \$50,000 in reorganization notes during the period it was operating under Section 77-B of the Bankruptcy Act.

It is estimated \$10,000 more of these notes will have to be issued to finance completion of the sale. These are offset by free assets of \$46,018 (from which \$12,496 in cash will be deducted) and an estimated equity on inventories of \$15,000. This gives a total of \$48,522 to meet the reor-

ganization notes which will leave a deficit of \$11,478 to holders.

Trustees were given authority to exhibit property of the company to prospective purchasers and to make any contracts with other manufacturing interests to use the building and equipment to keep down maintenance expense in the liquidation

Judge Knight's ruling brings to an end the history of one of the country's oldest auto manufacturing firms. Plans had been made to reorganize the company with Postmaster General James Farley as the new head and to enter the low-price car field this year, but adverse business conditions held up the plan and in the meantime financial difficulties have forced liquidation.

Fairbanks-Morse Pays Bonus

Bonus checks totaling \$106,114.54 were distributed April 1 to Fairbanks, Morse & Co. employes in conformity with a profit sharing program announced by company executives last year.

The amount set aside for bonus payments was based on earnings of \$2,148,432 during the fiscal year Total sales for the year were \$30,596,350, compared with \$26,827,-891 in 1936. Despite this 14.05 per cent increase in sales volume for 1937, net profit was off 4.64 per cent.

There were 4,472 employes of the company who were eligible to participate in the profit sharing plan. These included factory workers and others who were paid on a salary

sure seeking to establish uniform licensing laws.

Under the Truman bill a driver would be deemed to be driving in interstate commerce when traveling from "a point in one state to a destination in another." A driver having out-of-state tags would presumably be operating in interstate commerce, but the measure says that "such presumption shall not be conclusive." No policing difficulties are anticipated by sponsors as evidenced by their acquiescence to requests for eliminating the enforcement machinery provision. As passed, the penalty prescribed for violation is a fine of \$300.

Text of the Truman bill is as follows:

AN ACT

Prohibiting the operation of motor vehicles in interstate commerce by unlicensed operators.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That no person, except those hereinafter expressly exempted, shall operate any motor vehicle in interstate commerce or foreign com-merce unless such person has in his immerce unless such person has in his immediate possession a valid license, issued under the laws of a State conforming to the requirements set forth in section 2, permitting him to operate such vehicle in the State in which the license was issued: Provided, however, That nothing contained in this Act shall be construed to authorize a person to drive or to operate a vehicle engaged in the transportation of persons and property in interstate or foreign com-merce in violation of such regulations as the Interstate Commerce Commission may from time to time issue. Sec. 2. No license shall be held to permit

Sec. 2. No license shall be held to permit the operation of a motor vehicle in interstate commerce under the first section of this Act unless the law of the State in which the license was issued provides—

(a) That no license permitting the operation of a motor vehicle shall be issued except to persons passing an examination which includes a test of the applicant's eyesight (with or without spectacles), his

(Turn to page 536, please)

Truman Interstate Licensing Act

AAA Estimates Passage of Measure Would Affect License Laws in at Least Half of States

The Truman bill, requiring the licensing of motor vehicle operators in interstate commerce, would ban from interstate highways drivers from at least four states pending the time these states enact legislation meeting the minimum requirements set forth in the bill. They would be given four years to pass the necessary legislation.

The four states most affected by the bill include Florida, Illinois, Louisiana, and South Dakota, since they are without any form of license law excepting the licensing of chauffeurs

The American Automobile Association, which is actively supporting the bill in the interest of greater highway safety, estimates that at least half of the states would have to make their licensing requirements more stringent in order to have their drivers "honored" when traveling in other states. Briefly the AAA sums it up this way:

In 10 states—Alabama, Arkansas, Indiana, Maine, Minnesota, Missouri, Nevada, North Dakota, Texas and Wisconsin—no provision is made for a mandatory examination of applicants for license as is specified in the Truman measure. A score of states would find it necessary to otherwise strengthen license laws to meet the uniform standards of the Truman proposal.

State laws complying with the minimum standards of the bill would have to require applicants to undergo eyesight tests, show ability to read and understand highway signs regulating, warning, and directing traffic,

and demonstrate their ability to control a vehicle and exercise reasonable care at the wheel. A provision for revocation or suspension of licenses also would be required.

The Automobile Association concedes that the proposed legislation appears drastic on its face, but feels that the time lag provided is ample to permit states to meet the Federal standards. The National Highway Users' Conference has taken no position on the bill, although some of its members are known to favor the legislation, while others are opposed. The Motor Carriers Division of the ICC has endorsed the bill as passed by the Senate and is understood to have suggested certain modifications which were carried out by Congressional sponsors.

The Bureau takes the position that the legislation should not be controversial, pointing out that states without effective licensing laws have indicated a desire to pass more stringent laws pending the establishment of uniform standards.

The National Grange views the proposal as unnecessary and holds that the provision in the latest Cartwright bill, which requires states to take certain precautionary measures in the interest of highway safety to qualify for financial aid, is adequate.

The Automotive Safety Foundation of the Automobile Manufacturers Association has taken no definite position on the bill as it has had no discussion concerning it. It was stated, however, that the association was naturally in favor of any mea-

Aircraft Production Favorable

Standard Statistics Co. reports that, following the establishment of sales and profits at a new high level in 1937, the aircraft manufacturing industry promises to show highly satisfactory results for the current vear.

Unfilled orders at the beginning of 1938 are estimated to have been close to 50 per cent larger than total output for 1937, and with the sizable volume of new orders impending it is indicated that operations for the full year will be at practical capacity.

The high level of demand for export and for Army and Navy needs has counterbalanced some drop in scheduled deliveries to commercial airlines and the adverse effect of present business conditions on new private plane sales.

Goodrich Withdraws Commitments

Rescinds Proposal to Negotiate With URW on Wages, Hours and Operations

The wage and hour controversy that has been raging in the tire industry in Akron between tire company officials and leaders of the United Rubber Workers Union of the C.I.O., and which came to a sharp focus last month when the B. F. Goodrich Company gave union labor the choice of a substantial wage cut or the transfer of 5000 jobs out of Akron, reached a sudden and wholly unexpected impasse April 12 when the Goodrich management abruptly withdrew all commitments as to expansion of its Akron factories which it had made conditional upon the union's acceptance of the wage reductions. The company's sudden action, in the form of a letter from Vice-President T. G. Graham to L. L. Callahan, president of the Goodrich URW local, came upon the eve of a scheduled three-way conference between Goodrich officials, union leaders and representatives of the National Labor Relations Board, to discuss the board's proposal of a program to stabilize wages and hours in the Akron industry so as to obviate the necessity for further decentralization.

In its original proposal to the union, now withdrawn, the Goodrich Company had pledged itself, conditioned upon the union's acceptance of wage cuts of from 10 to 20 cents an hour, to negotiate with the union for the purpose of arriving at a written agreement on wages, hours and working conditions; to undertake no manufacturing operations in new locations for six months; to spend not less than \$1,500,000 during 1938 for modernization of its Akron factories; and to "freeze" hourly wage rates at the new levels for six months and in no event to reduce wages below the levels in force in April, 1936.

The Goodrich ultimatum was submitted to a union plebescite scheduled for March 20, but when union officials announced the vote would be confined only to union members in good standing, Akron civic leaders protested to the government on the ground that the employe referendum should embrace all workers affected whether union members or not. Less than 24 hours before the scheduled plebescite the referendum was indefinitely postponed.

In his letter to the union withdrawing the company's conditional commitments, Mr. Graham states:

"Inasmuch as you and the other officers of your union publicly recommended to your members the rejection of the proposal and since you have twice postponed a vote on the proposal, there is no purpose to be served by continuing the commitments made by our company in the proposal of March 9. We therefore withdraw the commitments therein made.

"Since March 11 we have not had any communication of any kind from your union relating to the proposal other than the telegram of March 20 notifying us officially that the scheduled vote of March 20 had been postponed. Akron hourly wages and our costs are excessively high as compared with hourly wages and costs in modern rubber plants outside of Akron. A very large part of our total production has been retained in Akron. Consequently the solution of these problems is of vital importance to our company.

"On February 10 when we formally brought these problems to (Continued on page 534)

Consolidated Aircraft Deliveries Up

Deliveries of airplanes and spare parts by Consolidated Aircraft Corp. during the quarter ended March 31 totaled \$3,379,740 against \$2,647,000 for the same period in 1937.

The corporation is working on a production schedule calling for approximately the same rate of production during the remainder of 1938, which would bring total 1938 deliveries to a round \$13,000,000 against \$11,907,492 in 1937, the present record high.

At the beginning of April, Consolidated still had unfilled orders for 85 P. B. Y. flying boats for the U. S. Navy, being the balance of orginal orders totaling 209 units. These contracts should be either actually or virtually completed by end of 1938, so that under the company's accounting policy, all of the profit from these orders will be reflected in this year's income account.

Libby-Owens Dividend

Libby-Owens-Ford Glass Co. declared a dividend of 25 cents on common stock payable June 15. The same amount was paid March 15.

John D. Biggers, president, declared the dividend was being paid out of surplus as "first quarter earnings were very disappointing."

Detroit SAE Session on Heat Transfer

Papers Presented on Engine and Brake Heat Transmission

An audience of almost 250 people crowded Detroit Section SAE technical session on the principles of heat transmission, this week. Two papers unique in SAE literature were presented—"Quantitative Analysis of Heat Transfer in Engines" by R. N. Janeway, head, dynamic research, Chrysler Corp., and "Fundamentals of Heat Transmission Applied to Automotive Brakes" by A. S. Van Halteren, development engineer, Motor Wheel Corp.

The first part of Mr. Janeway's presentation dealt with the fundamentals of heat transfer while the second part reconciled the empirical information with data taken from a test engine. One of the conclusions of the paper is that since the coefficient of heat transfer from the gases increases at a lower rate than piston velocity and charge density, thermal efficiency will be greater the higher the speed and volumetric efficiency. Conversely, it follows that the ther-

mal efficiency tends to be reduced at part loads.

W. R. Griswold praised the presentation, adding the thought that a paper of this kind makes for scientific progress and provides a useful working tool for the research man. Others who discussed Janeway's paper were N. N. Tilley, chief engineer, Continental Motor Co., aircraft division; Professor W. E. Lay, who submitted a special bibliography on heat transfer literature, and R. B. Sneed, Ethyl Gasoline Corp., whose work with supercharged engines confirms much of the conclusions stated in the paper.

Van Halteren's paper represents an attempt to apply fundamental heat transfer relations to an analysis of the brake problem, treating the brake as an energy converter. The conclusion reached by the author was that the problem involves too many unknown variables to permit the application of empirical analysis, except qualitatively to an extent. With present brake applications and body styling, the brake problem is extremely critical since brake heat is generated at a high rate whereas it is dissipated very slowly. The greater part of the heat stored in hubs and wheels is finally disposed of by convection rather than by radiation. Unfortunately, this function is not at all efficient since the reservoirs of heat are surrounded by pockets of dead air which retard heat dissipa-

Frank Martin, of General Motors Research, emphasized the many variables which are so difficult to evaluate. Among the most critical arevariations in geometry, value of rapid changes in coefficient of friction, and accurate measurement of high surface temperature. GMR laboratory studies indicate that brake drum local surface temperature may be of the order of 1400 to 1800 deg. Fahr., although such temperatures have never been measured. Special thermocouple arrangements have measured a temperature change of 800 deg. Fahr. in three seconds on severe brake application, and Mr. Martin believes that the actual skin temperatures may eventually be measured by the proper techniques.

L. A. Chaminade of Chevrolet spoke from the viewpoint of the brake problem as it appears in tests on the road. He is inclined to believe that the actual picture is not as bad as it is shown in the paper, also judging from the fact that the modern car does provide good braking performance. He observed that the rate of deceleration, fortunately, must vary inversely with car speeds since braking effort is limited by the coefficient of friction between the tire and the road. According to proving ground tests, maximum deceleration at 70 mph is about 14 ft. per second per second. Deceleration due to the engine and transmission used as a brake is of the order of 3 ft. per second per second.

In Mr. Chaminade's opinion, it is possible to obtain sufficient cooling to take care of normal brake applications. He praised highly the performance of the well-known disc type (Tru-Stop) propeller shaft brake which is capable of continuous heavy duty without fading or failure. He contrasted this with the performance of a contracting band brake with more drum area which nevertheless fails after severe applications in truck service. Superior performance of the disc type brake is attributed to excellent heat dissipating properties of the design.

Bendix Reorganization Completion Expected by End of Year

An optimistic view of the future was given at the annual meeting of the stockholders of Bendix Aviation corporation, held in South Bend, April 13. Vincent Bendix, president of the corporation, outlined plans and announced changes in personnel. It was announced that \$5,000,000 of debenture bonds of the corporation had been disposed of at private sale, the money to be used to pay off debts, finance construction of a new aviation plant at Bendix, N. J., and furnish new working capital. Increased production was hinted by spokesmen with the announcement that reorganization of the Bendix corporation is expected to be completed before the end of the year. The reorganization, it was said, would change the Bendix Aviation corporation from the status of a holding company to that of an operating company, with various activities of the company controlled by divisions. Economy of operation, achieved by the reorganization and the influence of General Motors cost economy system, may mean a reduction in operating costs sufficient to bring increased automobile accessory business from General Motors corporation. "Whether General Motors gives additional business to Bendix depends upon the success of Mr. Thomas in manufacturing quality products at a low price," a General Motors spokesman said. "However, the situation appears favorable for the Bendix corporation," David O. Thomas, formerly general manager of the Saginaw Malleable Castings division of General Motors. was recently named Bendix vicepresident in charge of the automotive division.

E. R. Palmer, formerly assistant comptroller of General Motors, who recently was appointed vice-president in charge of finance of Bendix, will be in charge of the reorganization program, it was indicated. The simplification of the Bendix corporate structure has been in process for several months but has been delayed by minority stock interests and patent suits pending in the subsidiary companies, it is said.

AMA Representatives to Attend Fair Trade Conferences

Members of the Automobile Manufacturers Association have agreed to send individual representatives to the fair trade practice conference to be conducted under Federal Trade Com-

mission auspices in Detroit on April 26, according to Alvan Macauley, president of the AMA and of Packard Motor Car Co. The decision was reached by directors of the association after they had been invited to participate in the conference by the

"Our executive committee feels that we should not oppose any impartial inquiry which brings out all the facts relating to the practices and policies which prevail in the distribution of automobiles," a letter from Macauley to the FTC states. The letter added that it was essential that sound competitive practices be fostered by all those engaged in nationally distributed products such as automobiles and also said, "On the other hand, artificial restraints of trade cannot help reacting adversely on the consumer, to the eventual detriment of those seeking to limit competition."

Production

(Continued from page 527)

evident under normal conditions. Production has not increased quite as much as sales with a resultant beneficial effect on field stocks. Several producers report that surveys of dealers' used car stocks show that, while still heavy, they are lower than a year ago at this time.-J. A. L.

Chicago Used Car Week

Based upon a survey conducted among all dealers in Cook County (Chicago), results of National Used Car Exchange Week are just made known by the Chicago Automobile Trade Association, through Samuel B. Shapiro, general manager.

A total of 334 dealers responded to the postcard questionnaire sent out by the Chicago Automobile

Trade Association.

The number of cars sold was 5404. and the dollar volume hit \$1,696,468, during National Used Car Exchange

Against the 5404 cars sold, 2864 used cars valued at \$542,031 were traded in. Reduction in used car inventory amounted to 2540 in units and \$1,154,437 in dollar value.

By comparison with the preceding week, National Used Car Exchange Week produced a gain of 2175 in number of cars sold and \$756,135 in dollar volume.

Further analysis discloses that the average value of cars sold was \$313 as compared with \$289 the previous

Business in Brief

Written by the Guaranty Trust Co., New York

Little improvement occurred in general business activity last week, and several lines received further setbacks. Sentiment during the earlier part of the week was affected by concern over the prospects for the passage of the bill for governmental reorganization, but the defeat of this legislation in the House of Representatives at the end of the week spread some encouragement. After holding fairly steady during the few weeks preceding, the index of business activity compiled by the Journal of Commerce declined last week. The figure stood at 69.7, as compared with 71.6 the week before and 101.0 a year ago.

Snow and generally unfavorable weather in several sections of the country retarded agricultural progress, but it apparently had little effect on Easter buying. Retail sales were from 2 to 5 per cent above those in the preceding week but were from 4 to 15 per cent below those in the corresponding period last year.

Freight Loadings

Railway freight loadings during the week ended April 2 totaled 523,489 cars, which marks a decline of 49,463 cars below those in the preceding week, a decrease of 197,740 cars below those a year ago, and a fall of 90,092 cars below those two years ago.

Production of electricity by the electric light and power industry in the United States during the week ended April 2 was 7.8 per cent below that in the corresponding period last year.

Lumber production during the week ended March 26 stood at 52 per cent of the 1929 weekly average. Production and new business were below the levels in the preceding week, but shipments were moderately higher.

Average daily crude oil production for the week ended April 2 amounted to 3,367,250 barrels, which marks a decline of 38,350 barrels below that for the preceding week and a fall of 55,100 barrels below that for the corresponding period last year.

Professor Fisher's index of wholesale commodity prices for the week ended April 9 stood at 80.9, as compared with 81.2 the week before and 81.9 two weeks before.

The consolidated statement of the Federal Reserve banks for the week ended April 6 showed a decline of \$1,000,000 in holdings of discounted bills.

Holdings of bills bought in the open market and Government securities remained unchanged. Money in circulation rose \$65,000,000, and the monetary gold stock increased \$9,000,000.

A new folder on machinery adjustment has been printed by Laminated Shim Co.*

The Brown Instrument Co. has issued a folder covering its pneumatic remote transmission.*

Reprints of a paper on "Zinc Alloy Die Casting—An Industrial Achievement" have been made available by the New Jersey Zinc $\operatorname{Co.}^*$

"Quit Your Skidding" is the title of a booklet on safe driving issued by the B. F. Goodrich Co.*

A booklet on motion-time analysis has been released by A. B. Segur & Co.*

Data on all types of Reaction, Absorption, Factionating, etc., Towers is available in a catalog by the Haveg Corp.*

Hobart Brothers Co. has issued a catalog on its new model multi-range arc welders.*

The General Electric Co. has published 11 booklets, as follows: GEA-2170A. Directional Distance Relays; GEA-2003B, High-Accuracy Commercial Testing Instruments; GEA-1929A, G-E Gear Motors; GEA-2716, D-C Cam-Type Drum Switches; GEA-2742, Pyranol Capacitors; GEA-841H, A-C Magnetic Switch, Size One; GEA-432C, Direct-Current Generators and Exciters; GEA-1283A, Cam-operated Master Switches; GEA-2426A, Outdoor Oil-blast Circuit Breakers; GES-1547A, Refrigerated Truck Bodies.

Flame hardening of lathe beds is discussed in a folder by the Monarch Machine Tool Co.*

Bearing Metals. Verbatim reprint of the article on the subject by P. M. Heldt. Copies of the March 19 issue of Automotive Industries in which the original publication of the article occurred have been exhausted. Reprints are being provided gratis on request while the supply lasts.*

March, 1938, issue of Industrial Standardization contains an article on the American Standard for safety glass, and a tabulation of state requirements for safety glass on motor vehicles. Copies of the article are 35 cents each. Address: American Standards Assn., 29 West 39th St., New York, N. Y.

The Electric Controller & Mfg. Co. has published a booklet entitled "We Raised Our Power Factor and Save \$900 a Year."*

Westinghouse Electric and Manufacturing Co. has issued a booklet on outdoor and indoor service socket instruments for industrial application.*

The uses of tractors and Diesel engines in the logging industry is the subject of a booklet offered by the Caterpillar Tractor Co.*

The DeVilbiss Co. has issued a catalog covering its complete line of industrial spray-painting and finishing equipment.*

*Obtainable from editorial department, AUTOMOTIVE INDUSTRIES. Address Chestnut and 56th Sts., Philadelphia.

... slants

LIVESTOCK—The part that motor trucks play in the livestock industry is revealed in a graph prepared by International Harvester Co. Drive-ins of livestock in 1937 were 52.05 per cent of the total receipts. In 1916 drive-ins were 1.61 per cent. Peak year was 1936 with 54.85 per cent of all groups of livestock traveling a la cart. Figures for several of the leading livestock centers in 1937 were: Chicago, 31.74 per cent drive-ins; Sioux Falls, 97.23 per cent; Indianapolis, 94.41 per cent; Oklahoma City, 87.44 per cent.

DEATH BEGINS AT 40—That's the title of a booklet prepared by the Travelers Insurance Co. which claims the basic reasons for the high accident record in this country for 1937 were too much speed and too little courtesy. A set of figures shows that if you have an accident while traveling under 40 m.p.h. there is only one chance in 44 that someone will be killed, but if your accident occurs while you are traveling faster than 40, there is one chance in 19 that someone will be killed.

FLEDGLING PROMOTION—A private flying section which will be devoted to the encouragement and stimulation of all phases of private flying is being established in the safety and planning division of the Bureau of Air Commerce, Department of Commerce, it has been an-



The Parker Rust-Poof Co. has published a pamphlet on **Bonderizing.***

Information on Spring Principles and Design is given in a catalog issued by the Raymond Manufacturing Co.*

The Bijur Lubricating Corp. has released Bulletin "G" presenting a round-up of Bijur advertising in technical and trade journals covering automatic, centralized, pressure lubrication.*

The Travelers Insurance Co. has published a booklet entitled "Death Begins at 40" on safe driving.*

"Taxes and American Progress," a commentary upon national policies in relation to the proposed revenue act of 1938, has been released by the Machinery and Allied Products Institute.*

A catalog on its normal pitch and space measuring machine has been published by the Illinois Tool Works.*



Acme Photo

STREAMLINE-UP When schedules brought five of the 14 streamliners of the Santa Fe railroad together the photographer thought it a good time to snap these time-attackers. The trains are, from left to

right, The Super Chief, No. 1; El Capitan, No. 1; The Chief; The Super Chief, No. 2; El Capitan, No. 2. The Chief is a steam train, the others are Diesel powered. The picture was taken in the Chicago yards.

nounced by assistant secretary Col. J. M. Johnson.

The new section is being formed in order that the bureau may more effectively discharge its functions in connection with the fostering of private flying (as distinguished from airline operations) including flying for sport and pleasure, business and student instruction.

40 Years Ago

with the ancestors of AUTOMOTIVE INDUSTRIES

The Popp Motor Vehicle

"These vehicles which are about to be placed on the market in France, according to *La Locomotion Automobile*, are noteworthy in several respects.

"The frame carrying all the machinery is supported by springs. It is made of a light metal called 'par tineum,' said to unite in itself the qualities of aluminum and steel.

"The motor, invented by M. Lacaste, has two cylinders, and is extremely light, weighing for four horsepower only about 125 pounds. Only one joint is found in it connecting the cylinder and the valve box. All the mechanism is accessible from above, so that it is unnecessary to dismount to make any repairs. The motor itself is started from the seat.

"Four speeds, with a maximum of 25 miles an hour, and a reverse, are provided by gears, transmitting power through a chain to the middle of the axle.

"In the electric igniting device the porcelain insulator is not cemented to the metal, but merely fastened by a coating of asbestos, hence it can be replaced in a few minutes.

"The wheels are either of wire or of wood with bronze hubs."

From The Horseless Age, May, 1898.

GM Dealer Council Plan to Be Extended

The scope of the General Motors Dealer Council Plan, which has been in operation for more than three years as a means of promoting more effective and equitable factory-dealer relationships, is being broadened, it was announced in a message to General Motors dealers from Alfred P. Sloan, Jr., Chairman of General Motors Corporation. The announcement was made following a regular meeting of the Northeastern and Southeastern groups of the Dealer Council in New York.

The new arrangement will supplement but will not replace the present General Motors Dealer Council Plan, in which four groups of twelve dealers, from the Northeastern, Southeastern, Western and Pacific Coast regions of the country, meet regularly with General Motors officials for the discussion of matters of mutual interest. These discussions do not deal with problems of administration, as such, but are concerned with the broader phases of distribution policies.

Appropriation Bill Provides for \$100,000,000 Highway Fund

National Highway Users Conference reports that the appropriation bill providing for the United States Department of Agriculture has just been reported out by the House Committee. It contains a provision for the appropriation of \$100,000,000 for highways for the fiscal year 1939. This figure is made up of \$63,000,000 for regular Federal aid, \$10,000,000 for secondary or feeder roads, \$20,000,000 for grade crossing eliminations, and \$7,000,000 for forest highways.

The Hayden-Cartwright Act of June 16, 1936, provided authoriza-

tions in the sum of \$238,000,000 for each of the fiscal years ending June 30, 1938 and 1939, of which \$216,500,000 would come through the Department of Agriculture. This new appropriation bill, if permitted to stand, is in accord with the President's budget and will be in line substantially with his message of November 30 last. An amendment substantially in line with the authorization has been prepared.

Representative Cartwright, chairman of the House Committee on Roads, and the author of H. R. 10140, the proposed Federal aid bill for 1940-1941, has submitted a communication to the Chairman of the Subcommittee on Appropriations suggesting that the 1939 appropriation should carry an additional \$101,500,000. Of this, \$92,000,000 would be for Federal aid, grade crossing eliminations, and secondary or feeder roads; \$2,500,000 for public land roads, and an additional \$7,000,000 for forest highways. This \$7,000,000 for forest highways included in the reported bill will be sufficient only to take care of work now under way.

Tokyo News

(Continued from page 528)

promoting a parts manufacturing enterprise to be capitalized at 3,000,000 yen. The Japan Typewriter Company, the leading firm in this field, is planning to go into parts manufacture. Its Shanghai and Tientsin plants may be enlarged for this purpose.

Leading Japanese automobile manufacturers have been very active of late in boosting parts manufacturing through advancement of loans to their subcontractors. As a result, well-equipped large-scale enterprises are gradually superseding the small household shops.

Labor

(Continued from page 527)

desired by the union, or will be subject to certain modifications.

A truce between union employes and the Federal Screw Works, which had been preceded by a strike resulting in a series of battles between police and pickets, ended peacefully on April 10 after members of the West side local, which included the plant, had approved a new contract signed the night before by company and union representatives. Following the signing of the agreement the company issued the following statement:

"The UAW have agreed that on Sept. 1, 1938, the company's minimum wage rate in its Detroit plant shall be reduced to the average minimum wage rate then being paid by other plants (including out-of-state plants) engaged in the manufacture of screw machine products and bolts and nuts. The management believes this to be a constructive and progressive step which should ultimately serve to place the company on a sounder competitive basis.

"Present wage rates in the company's Detroit plant have been extended for 60 days, subject to adjustment at that time or any subsequent 30-day period prior to Sept. 1 providing same should be necessitated by changes in business conditions."

Goodrich-URW

(Continued from page 530)

your attention, and during the many days of negotiations which followed we were hopeful and confident that with the cooperation of our Akron employes and your union, our problems might be solved in the Akron plants of our company. We regret that after two months no solution has been reached."

In view of the fact that Goodrich, followed by Goodyear and Firestone, enforced salary reductions of from 10 to 20 per cent April 1 for all salaried employes, tire industry observers profess to see in the Goodrich company's latest move the setting of the stage for a probable arbitrary wage cut without any employe referendum. At the time the company originally proposed the wage cuts, union leaders challenged the company to reduce office salaries before reducing wage envelopes. Now that this has been done, observers say automatic

wage cuts would seem to be inevitable.

James L. Miller, regional director of the NLRB, had his program for hour and wage stabilization ready to submit to the union and Goodrich management April 13, but it appeared probable that this conference would be postponed due to the absence from the city of Mr. Graham.

Figures allegedly indicating sharp curtailment of tire and tube production in the Goodyear Tire & Rubber Company's Pacific Coast plant at Los Angeles were made public in Akron April 12 by Thomas F. Burns, vice-president of the United Rubber Workers Union of the C.I.O. Burns declared a telegram from George Burdon, president of the Goodyear local at Los Angeles, indicated that production and employment there paralleled the Goodyear company's Akron retrenchment.

"Tube ticket cut to 5000 daily. Tire production schedule reduced to 13,000 weekly. This schedule in effect until May 15. Factory working 16 and 18 hours weekly. Two hundred lay-off notices received today. One hundred more contemplated," Burdon wired, according to Burns. John House, president of the Goodyear Akron local, asserted the company in the last six months had laid off approximately 600 at Los Angeles.

Books

of automotive interest

PLASTICS, by S. Ranganathan, B.A. and H. K. Sen, M.A., P.R.S., D.I.C., D.Sc. Reprinted from the Proceedings of the Institution of Chemists (India).

The paper deals briefly with all of the industrial plastics now in common use, tracing the history of their development and giving their properties and applications.

JAHRBUCH DER BRENN-KRAFTTECHNISCHEN GESELL-SCHAFT (Yearbook of the Motor Fuels Society), Vol. 18 (1937). Published by Wilhelm Knapp, Halle (Saale), Germany.

Aside from a report of the annual meeting of the Society, the Year-book contains five papers on motor fuel subjects, as follows: The Internal Combustion Turbine, by Prof. Dr.-Ing. Georg Mangold; Tests on the Hesselman Engine, by Prof. Dr.-

Ing. W. Wilke; Diesel Locomotives with Direct Drive, by Dr. Finsterwalder; Automotive Generators for Low-Temperature Coke, by Dipl.-Ing. K. Hausmann; Improvement in the Hill-Climbing Ability and Roadability of Diesel Trucks, by Dr.-Ing. B. Klaften.

ELEKTRISCHE ZÜNDUNG, LICHT UND ANLASSER DER KRAFTFAHRZEUGE (Electric Ignition, Light and Starters of Motor Vehicles) by Dr.-Ing. E. Seiler. Third Edition. Published by Wilhelm Knapp, Halle (Saale), Germany. (In German).

This book covers the field of electrical equipment for motor vehicles quite thoroughly in its three-hundred odd pages and with its more than three-hundred illustrations. New in the third edition is additional material on the physical phenomena of the ignition spark, the theoretical problems involved in the development of ignition systems are dealt with in more detail than in the previous edition, and a comprehensive bibliography on electrical equipment has been added.

GASOLINE-ALCOHOL BLENDS IN INTERNAL COMBUSTION EN-GINES, by L. C. Lichty and C. W. Phelps, No. 31 of Publications from the School of Engineering of Yale University.

This pamphlet, which is reprinted from Industrial and Engineering Chemistry, deals with research work on the use of blended fuels containing from 5 to 20 per cent of anhydrous denatured ethyl alcohol in the C.F.R. test engine. Characteristics studied in the single-cylinder engine included mixture temperatures, volumetric efficiency, power output, fuel economy, and exhaust temperatures. Similar tests were made in a multicylinder engine.

CUSTOM HOUSE GUIDE (76th Year), 1938 edition, published by Custom House Guide, Box 7, Sta. P, Custom House, N. Y. \$15.00.

This book contains the new U. S. Customs Regulations of 1937, which entirely revise and supersede the old 1931 Regulations.

Because of the inclusion of the new rates of duty established under the sixteen reciprocal trade agreements which have been concluded by the U. S. with foreign nations and of the many revisions enacted by Congress, the new volume is completely revised this year.

American Import & Export Bulletin, issued monthly as a supplementary service to the annual guide, will contain revisions to the Annual and a monthly coverage of all the latest

rules, decisions, regulations, laws, reciprocal trade agreements, etc., affecting foreign traders.

We have received copies of the first three issues of a new series of research reports to be issued under the general title DEUTSCHE KRAFTFAHRTFORSCHUNG, IM AUFTRAG DES VERKEHRSMINISTERIUMS (German Automotive Research, on the order of the Minister for Transport). The reports are being published by V. D. I. Verlag, GmbH, Berlin, NW 7, Germany.

No. 1 of the reports deals with Air Resistance of Motor Vehicles, Tests on Vehicles and on Models, and is by Dipl.-Ing. C. Schmid, of the Motor Vehicle and Motor Research Laboratory of Stuttgart Technical College. No. 2 covers Heating of Tires of Passenger Cars at High Speeds, and is by Dipl.-Ing. Werner Brunner of the Laboratory for Technical Physics of Munich Technical College. third issue is devoted to Specific Output and Economy of Automotive Engines Operating on Gas, the author being Dr.-Ing. W. Rixmann, of the Motor Vehicle Laboratory of Berlin Technical College. All of the reports contain numerous tables and illustrations, and all are printed in German.

IS TAFEL FUR LUFT UND VER-BRENNUNGSGASE (Enthalpy and Entropy Chart for Air and Gases of Combustion), by O. Lutz and F. Wolf of the German Research Institute for Aviation, Braunschweig. Published by Julius Springer, Berlin.

This is a small pamphlet containing four illustrations and five charts in the text, which is accompanied by a large entropy chart printed in two colors. Such a chart is useful in research work on combustion turbines and compressors, and it is particularly desirable that all of the gases of combustion be covered in a single chart, which is the case here. The chart makes use of E. Justi's results regarding the specific heats of gases and their dependence on the pressure, as well as regarding dissociation. It covers a temperature range of minus 100 to plus 1400 deg. Kelvin, and a pressure range of 0.05 to 30 kilogram per square centimeter. On the enthalpy or total-heat scale, 50 mm. (about 2 in.) = 1000 kg.calory per kilogram-mole, while on the entropy scale, 50 mm. = 1 kilogram-calory per kilogram-mole-deg. The base pressure and temperature are taken as 1.033 kg. per sq. cm. (standard atmospheric pressure) and 273.2 deg. K. (32 deg. F.). price of the pamphlet with entropy chart is three marks.



Broach Sharpening

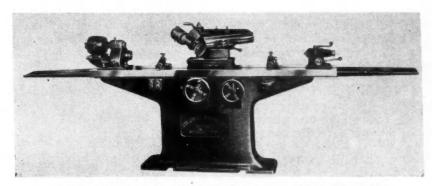
. . . Colonial's new machine handles both flat and round types

A new broach sharpening machine designed to handle both flat and round broaches has been built by Colonial Broach Co., Detroit.

The sharpener is provided with a grinding head adjustable through an arc of 180 deg. horizontally. Vertically, the head is adjustable from a horizontal position to 90 deg. below horizontal. The head is fitted with a hardened and ground slide traveling on two hardened and ground roller chains riding on hardened and ground ways in the head support. The rolls are held to 0.0002 in. for diameter and the entire slide mechanism is sealed against the entry of grinding dust. The head is also adjustable for side play.

over-all of 72 in. Adjustment of the table is through a worm and wheel, the worm being operated through a graduated hand wheel. For work requiring extraordinary accuracy a vernier worm and wheel mechanism can be supplied to operate the main hand wheel, permitting adjustments to 0.0002 in. The table is carried on one vee and one flat guide, the guides being lubricated by rollers running in oil wells.

For grinding round and spline broaches, etc., there are provided a head stock, a tail stock and steady rests. The head stock is of the two speed motor-driven type fitted with a 1/3 hp., 1200 r.p.m. motor. The head stock has a center swing for 10 in.



Broach sharpening machine for flat and round broaches built by Colonial Broach Co.

Grinding wheels are 5 in. in diameter with ½-in. face, for sharpening. For backing off, a 3-in. diameter wheel is furnished. The grinding wheel spindle is direct motor driven with a standard speed of 3600 r.p.m., the motor being of ¾ hp. The spindle is carried in adjustable pre-loaded, double-row bearings and is totally enclosed. Frequency changers permit operation of the grinding wheel spindle at speeds up to 10,800 r.p.m. Maximum travel of the slide is 10 in.

Adjustment of the grinding head column vertically is by means of a hand-wheel, one complete revolution of which equals 0.025 in. of column lift. The maximum range of adjustment is 10 in. Hardened and ground ways are provided for the column.

The broach sharpener table has a 1,859,530 as compared with 6,312,15 maximum travel of 60 in. with an for the first three months of 1937.

diameter maximum. The tail stock is of the quick adjustable type and is provided with an adjustment permitting setting broach ends up to $1\frac{1}{2}$ in. off center for tapering of broaches.

Steady rests are of the barrel type taking $\frac{1}{2}$ in. round fibers. They are cam locking and so designed that a single adjustment actuates both sides of the jaws in setting up.

Decline In Rim Inspections

The Tire and Rim Association reports 854,031 rims inspected and approved for March, 1938, as compared with 2,166,218 for the same month last year. Total for the first three months this year was announced as 1,859,530 as compared with 6,312,199 for the first three months of 1937.

Automotive Metal Markets

Broadening Buying in Aluminum Market Looked for as Result of Research on Cylinder Heads

A striking anomaly of present-day metal market conditions is the utter failure of bargain prices as a means of quickening buying. When Straits tin was offered a few days ago at 374/5 cents a pound, not only the lowest price in five years, but also nearly 10 per cent below the average price for the last ten years, consumers failed to budge from the sidelines. It wasn't long before higher cables caused the price to move upward and cross 39 cents. The remarkable thing is, tin brokers point out, that with financing of commodity transactions as easy as at present, consumers fail to show the slightest interest in saving money through anticipating their requirements in even a modest way. In the copper market, a sharp rise in foreign demand, foreshadowing the possibility of higher prices here, also failed to stir consuming interest. Speculative holders withdrew prices below those of producers and custom smelters, but export buying on a single day exceeded that for domestic consumers' account in an entire week. A sharp cut in the price of zinc failed to smoke out very much in the way of consuming demand with the result that the majority of marketers withdrew from competing for business at the prevailing quotation, preferring to wait for a stiffening in the attitude of those who sought to lighten the surplus by cutting the price.

Dissension among the signatories of the International Tin Agreement continues to be an unsettling factor in the tin market. Agitation for a referendum on the proposed buffer stock scheme is becoming more pronounced, the tin miners of the Malay States, many of them Chinese, are thoroughly dissatisfied with the present set-up, and there is talk of petitioning for withdrawal from the international pact. Production costs of the Billiton and Banka companies in the Dutch East Indies are lower than those of the Federated Malay States mining companies and the Hollanders are, therefore, credited with holding the whip-hand. All of which turmoil might lead to further dislocation of the tin market, so that the offishness of American consumers, prompted though it is by entirely different motives, may still prove to have been the correct attitude. On Tuesday the market was a fraction lower than at the beginning of the

week, spot Straits being offered at $38\frac{1}{2}$ cents.

In the aluminum market, broadening of buying by automobile manufacturers is looked for as the result of an intensive research program set up to assemble data bearing on economies attainable with aluminum cylinder heads. A development, that is coming in for considerable attention, is the growing interest in aluminum manufacture in Holland, bauxite supplies in the Dutch East Indies having led to the decision to construct a plant for alumina reduction in that colonial possession.

Lead holds steady at unchanged prices.

Not much change is noted in the steel situation, primary as well as finishing operations continuing at between 30 and 35 per cent of capacity. The ten open-hearth furnaces of Ford are temporarily inoperative. A good many of the smaller steel mills are taking advantage of the lull to put their equipment into the best possible condition and making minor improvements, to insure the greatest possible efficiency when demand makes itself more perceptibly felt.—W. C. H.

Truman Bill

(Continued from page 529)

ability to read and understand highway signs regulating, warning, and directing traffic, and an actual demonstration of ability to exercise ordinary and reasonable control in the operation of a motor vehicle.

(b) That such license must be renewed at least once in each three-year period.
(c) That it shall be unlawful for any person to (1) display or have in his possession any canceled, revoked, suspended, fictitious, or fraudulently altered license, or (2) to lend his license to any other person or knowingly permit the use thereof by another.

(d) That no such license shall be issued to a person who is not sixteen or more years of age.

years of age.

(e) That such license shall contain a full and complete description of the person to whom it was issued.

(f) That such license may be revoked or suspended by the proper authorities.

Sec. 3. Any person operating a motor vehicle in interstate commerce shall display his license upon the demand of any law enforcement officer, but no person shall be convicted for a failure to so display his license if he produces in court a license issued to him and valid at the time of such alleged failure.

Sec. 4. Any person who violates any provision of this Act shall, upon conviction thereof, be fined not more than \$300.

vision of this Act shall, upon conviction thereof, be fined not more than \$300. Sec. 5. (a) As used in this Act—

(1) The term "license" means a license or operator's permit for the operation of motor vehicles.

(2) The term "State" means any of the several States or the District of Columbia.

(3) The term "interstate commerce" means transportation (including the propulsion of a motor vehicle under its own power) from a point in one State to a destination in another State or between points in the same State but through another State; and the term "foreign commerce" means transportation (including the propulsion of a motor vehicle under its own power) from a point in the United States to a point in a foreign country, or between points in the United States and through any foreign country. The operation of a motor vehicle, in any State, on which there are registration or license plates issued by another State shall create a presumption that such vehicle is being operated in interstate or foreign commerce, but such presumption shall not be conclusive.

(b) The provisions of this Act shall not apply to any person while operating a motor vehicle in the service of the Army, Navy, or Marine Corps of the United States. Sec. 6. This Act shall take effect four years after the date of its enactment.

years after the date of its enactment.

Passed the Senate January 5 (calendar day, March 31), 1938.

Attest: EDWIN A. HALSEY, Secretary.



A me Photo

JOSEPH B. EASTMAN

. . . interstate commerce commissioner, as he testified before a Senate subcommittee on proposed amendments to the Motor Carrier Act. He said that the amendments were designed to expedite commission regulation of that form of transportation.

Tax Refund Suit Entered By Dodge Brothers

A suit in the Baltimore Federal Court has been filed by Dodge Brothers, Inc., asking a refund of \$374,-682.15 from the government for alleged over-payment of 1925 income taxes.

The automobile firm claimed several allowances to which it said it was entitled had not been granted by revenue collectors, and alleged that the 1925 total tax payment of \$2,-050,341.61 was excessive.

SAE National Tractor Meeting Held in Milwaukee

The National Tractor Meeting of the Society of Automotive Engineers, held in Milwaukee, April 14-15, brought together designers and engineers intent on building longer life, better efficiency and greater economy into tractors.

E. G. Boden, experimental engineer, Timken Roller Bearing Co., presented the meeting's opening paper, "Deflection Tests on Trans-

missions and Axles."

The symposium on engine wear brought seven authorities together to discuss ways and means of designing more life into tractor engines. Engineers participating and their subjects were: A. T. Colwell, vice president, Thompson Products, Inc., on valves and valve gears; K. W. Connor, president, Pneumatic Hone Corp., on shop practice; C. M. Larson, chief consulting engineer, Sinclair Refining Co., on lubrication; Macy O. Teetor, in charge of research engineering, Perfect Circle Co., on piston rings and cylinders; E. S. Twining, acting chief engineer, Champion Spark Plug Co., on spark plugs; Howard M. Wiles, research engineer, Waukesha Motor Co., on dust house testing, and John S. Erskine, engineering specialist, International Harvester Co., on hardened crankshafts and cylinders.

Argentine Automobile Display Double Size of N. Y. Show

Figures released by the Pan American Union concerning the Argentine automobile show, held recently in Buenos Aires, may serve to give some indication as to Argentine's present position and future possibilities as a market for cars and trucks. Five hundred different models of 59 different makes of cars and trucks were exhibited at the 1938 show. about double the number displayed at the New York show. Of the 37 different makes of cars on exhibition 19 were American, 8 German, 6 English, and one each from Italy, France, Sweden and Czechoslovakia. Of the 22 makes of trucks, 12 came from the United States, 4 from Germany, 4 from England, and one each from Sweden and Argentina.

The principal factor behind Argentina's increasing importance as a market for automobiles, according to the Pan American Union, is the government's vast road-building program. In 1935 there were 140,008 miles of roads in the republic and by the end of the next year this figure had risen to 213,779. Argentina

claims the greatest number of automobiles of all the Latin America republics, with 247,970 at the end of 1937. Brazil was second with 144,000.

Pan American stated that in 1936, 94 per cent of the motor vehicles in operation were of American make.

GM March Car Sales

Sales of General Motors cars to consumers in the United States totaled 100,022 in March compared with 196,095 in March a year ago. Sales in February were 62,831. Sales for the first three months of 1938 totaled 225,922 compared with 340,693 for the same three months of 1937.

It was stated that in the first two months of 1937 sales were curtailed by the shortage of cars caused by the General Motors strike, and that this contraction of the flow into consumers' hands was followed by an unusually sharp expansion in March, 1937, as settlement of the strike made possible the resumption of production.

Calendar of Coming Events

Conventions and Meetings

Greater New York Safety Council, Inc., Ninth Annual Convention, New York City,

April 19-21
Chamber of Commerce Meeting,
Washington May 2 to 5
American Foundrymen's Association, Foundry Show, Cleveland May 14-19
National Battery Manufacturers' Association, Spring Convention, Cleveland May 24-25

American Iron & Steel Institute
Meeting, New York May 26
SAE Summer Meeting, White
Sulphur Springs, W. Va.,

American Society for Testing
Materials Meeting, Atlantic
City, N. J. June 27-July 1
National Petroleum Association
Meeting, Atlantic City, N. J.

Sept. 14-16
American Welding Society Meeting, Detroit Oct. 17-21
National Safety Council Meeting, Chicago Nov. 14-18

American Petroleum Institute Meeting, Chicago Nov. 14-18 National Industrial Traffic League Meeting, New York

Nov. 17-18 National Standard Parts Association Meeting, Chicago Dec. 9-10

Car Sales in Canada Show Recent Improvement

Car sales in Canada are improving and have been on the upgrade for the last three weeks with manufacturers confident that total sales for the car year, (to the end of September) will not be very far short of 1937. In the western provinces there has been a noticeable pick up of orders, especially in those sections of Manitoba and Alberta where good crops were harvested last year.

No manufacturing difficulties are anticipated this season. Serious strikes are not expected, nor any of last spring's hold up in necessary parts imports from parent factories

in the united States.

The trend toward medium priced cars in Canada continues with recent gains more pronounced in lines which sell around \$1,200 rather than \$1,000.

Marketing Laws Survey Announced by WPA

Approval of a project to survey state marketing laws throughout the United States has been announced by Corrington Gill, Assistant Administrator of the Works Progress Administration. The survey is designed to obtain legal and economic data concerning laws on the state statute books and make it available in useful form to all Federal and State governmental agencies, trade associations, businessmen, lawyers, students and teachers of law and marketing.

As the survey progresses, special State relief projects to obtain economic data will be established under the sponsorship of State universities or other public agencies where recent State laws have been operated long enough to produce effects. Field work to obtain legal information on the state marketing laws will be carried on in cooperation with the existing machinery of the WPA Historical Records Survey staff of workers.

"Any legislative control designed to increase or curtail the flow of goods," said Mr. Gill, "is reflected in varying degrees in payrolls and employment. A knowledge of these controls is prerequisite to an effective study of unemployment. Legal and economic information is lacking not only on recently passed State marketing laws, but also on those State laws pertaining to the whole field of business controls which have been on the statute books for some time.



In order to give readers of Automotive Industries a clue to certain merchandising and service aspects of the automotive industry which are normally outside the scope of an industrial publication, we present herewith excerpts from the March issues of the four other magazines published by the Automotive Division of the Chilton Co.: Automobile Trade Journal, Commercial Car Journal, Motor Age, and Motor World Wholesale.

From Commercial Car Journal .

Acting upon a suggestion of the Interstate Commerce Commission in its railroad rate decision of March 8, in the so-called 15 per cent case (ex parte 123), the American Trucking Association, Inc., has published a master tariff for all interstate motor carriers raising rates substantially to the parity of advances granted rail carriers. The ATA was permitted to intervene in the 15 per cent case with the distinct reservation that no findings would be made or order entered in respect to its petition. The ATA petition submitted evidence concerning the relations between motor and rail rates and as to the financial and economic condition of the motor industry as a whole.

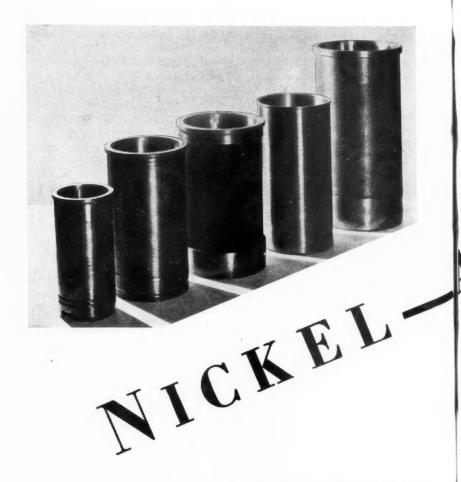
From Motor World Wholesale

The biggest inherent weakness.
. . In the code of fair trade practices for the automobile industry. . . . it seems to us, lies in the trade practice conference method itself. . . . The guys who are willing to sign a code and live up to the rules are ethical business men now and don't need a code—while the guys who should sign it can't be made to and it's a good bet that they won't—so what the—?

From Automobile Trade Journal

(From "Off The Record"
Department)

"According to the NADA Bulletin, dealers in Manchester, England, have induced insurance companies to insure certified cars that (Turn to page 554, please)



By H. E. BLANK, JR.

TICKEL was one of the first alloying elements to be utilized by automobile designers and its applications are continuously being extended by metallurgists responding to the industry's persistent demands for materials which—as Mr. Kettering of General Motors Corp. delights in pointing out—must do the impossible. Many parts of motor vehicles are now fabricated from a

large variety of metals in which nickel is an influential constituent, including steels, cast irons, ironnickel alloys, high-nickel alloys, and numerous non-ferrous alloys, including copper and aluminum.

There seems to be a marked trend toward the adoption of higher nickel alloy steels and nickel cast irons for an increasing diversity of parts built into buses, heavy trucks, and trailers. Improved highways have somewhat lessened the need for ruggedness in passenger car construction, and for certain parts there is some disposition to favor the plain carbon steels over alloy steels. However, there is a noticeable broadening in the application of the lower cost nickel alloy

Automotive 14 Automotive Materials

Nickel cast iron cylinder liners manufac-tured by Frank Foundries Corp.

steels to passenger vehicles. tractors and other agricultural machinery, nickel is being employed in greater volume for alloy structural steels, and also for nickel cast iron, from which tractor engine cylinders and other parts exposed to abrasive wear are fabricated.

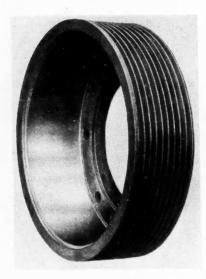
Recent trends include increasing consumption of stainless steels; more use of nickel-molybdenum steel for highly stressed parts of commercial vehicles, and of nickel alloy cast iron for such parts as cylinders, clutch plates, brake drums, exhaust manifolds; and growing acceptance of nickel cast iron for camshafts and crankshafts.

Nickel-Alloy Steels

Significant among the nickel steels are the stainless steels and the lowalloy, high-tensile, corrosion-resistant steels. Much of the stainless steel output is consumed for trim and other non-stressed parts, or parts stressed only by hand operation. These applications of the material have been aptly termed "items of fashion." They are not vital to construction and are mainly used to enhance exterior appearance. More important from the design viewpoint are those applications wherein advantage is taken of the properties of these alloy steels to provide high corrosion resistance and facilitate weight reduc-

Most widely known of the highnickel-content, stainless steels is the "18-8" specification, which contains 18 per cent chromium and 8 per cent nickel. This material is especially





Nickel cast iron brake drum produced and used by Mack International Motor Truck, Corp.

suitable for the fabrication of truck bodies and is being used in increasing amounts for this purpose. Although the "18-8" sheets are very thin, they have great strength and durability. The "shotweld" process of fabricating chromium-nickel stainless steels, which was introduced by the Edward G. Budd Mfg. Co. in the production of light-weight, stainlesssteel trains, is used to great advantage in truck-body manufacture. Riveting is eliminated, and what is virtually a one-piece body results, which needs no special finish and is therefore inexpensive to maintain. The first commercial airplane fabricated of stainless steel was built about two years ago by Fleetwings, Inc. There promise to be some interesting developments in this last mentioned application in the not-toodistant future.

Low-alloy, high-tensile, corrosionresistant copper-nickel alloy steels are characterized by higher strength, relatively lower cost, and better corrosion resistance than plain carbon steel or the ordinary copper-bearing steels. Most steels of this type are marketed by steel manufacturers as proprietary products. Some trade names and producers of such steels containing nickel are: "Double Republic Steel Corp.; Strength.' "Hi-Steel," Inland Steel Co.; "HT-American Rolling Mill Co.; "Mayari R," Bethlehem Steel Co.; and "Yoloy," Youngstown Sheet & Tube Co.

"Yoloy" was recently used in the construction of 300 Gar Wood refuse body units. In addition to permitting substantial reductions in weight, the use of "Yoloy" is expected to pro-

vide longer service life to these units because of its corrosion-resistant properties. The bodies are mounted on GMC truck chassis which employ nickel-alloy steels for many vital parts, such as gears in both the transmission and rear end, axle shafts, rear-axle worms, steering mechanism, crankshaft, valves, and all engine bolts, studs, and nuts. "Yoloy" has also been adopted by Gar Wood Industries, Inc., for its hydraulic road scraper. A photograph of this equipment appears on page 539. By the use of alloy steel the weight of the 10-cu. yd. unit was



Ni-resist exhaust manifold made by Frank Corp.

reduced from 18,500 lb. to 13,500 lb.

Another example of the elimination of dead weight in highwaytransportation equipment through the use of nickel-chromium steel is found in the commercial trailer frames recently built by the Utility Trailer Mfg. Co. Bethlehem Steel Co. supplied this steel, which was used in the as-rolled state. Despite the fact that the carbon content of the alloy steel used was below 0.15 per cent and the member was not subjected to heat treatment, the strength of the metal was sufficiently high to allow considerable reduction in section dimensions, so that the weight was cut 25 to 30 per cent, as compared to a similar unit built of plain carbon steel.

Specific applications of nickel alloy steels to the modern automotive chassis are listed in the table on this page. As indicated by the table, the material is used in steering knuckles, steering arms, connecting rods, connecting-rod bolts, engine bolts and studs, and spring clips. Nickel-alloy steel is used for shafting, especially for heavy duty installations, because it provides torsional properties which are superior to those characteristic of carbon steel. Case - hardened nickel - alloy steels are suitable for transmission spline shafts and transmission coun-

SAE Numbers of Nickel Alloy Steels Used on Passenger Cars, Trucks and Buses

Connecting rod bolts, SAE 2330, 3130, 3140
Connecting rods, SAE 2340, 3135, 4340
Crankshaft, SAE 3140, 3240, 4340
Differential cross, SAE 2315, 3115, 4615
Engine bolts and studs, SAE 2330, 3130, 3140
Exhaust valves, 16 Cr, 14 Ni; 21 Cr, 12 Ni; 16 Cr, 14 Ni, 4 W; 20 Cr, 1.5 Ni, 3 Si. Frame (trucks and buses), SAE 3130
Inlet valves, SAE 3140
King pin, SAE 2315, 2515, 3115, 4615, 4620
Overdrive units, SAE 4615, 4815
Piston pins, SAE 2315, 2515, 3115, 4615
Piston struts, 32% Ni (low expansion) steel
Propeller shaft, SAE 3130, 3140
Rear axle drive gear and pinion, SAE 2315, 2515, 3115, 4615
Rear axle drive shaft, SAE 2340, 3140, 4340
Roller bearings, SAE 4620, 4320
Shackle bolts, SAE 2315, 4620
Spring clips, SAE 2335, 3135
Steering ball stud, SAE 2315, 2515, 3135, 3140, 3215, 4615
Steering gear and follower, SAE 4320, 4615
Steering gear and steering arm, SAE 2335, 3130, 3135, 3140
Transmission gears, SAE 2315, 2515, 3150, 3312, 4620, 4640
Transmission spline shaft, SAE 2515, 3150, 3312, 4620, 4640
Transmission spline shaft, SAE 2515, 4620
Trim, 18 Cr, 8 Ni; 12 Cr, 12 Ni
Universal joints, SAE 2315, 3115, 4615

Typical	Alloys	Containing	Nickel	Used	in	Engine
	Cons	struction (N	on-Fer	rous)		

APPLICATION †			СН	EMI	CAL C	OMPO	SITIC	N			N	MECHANI	ICAL PR	OPER	TIE	S
	Aluminum	Copper	Tin	Lead	Silicon	Iron	Nickel	Magnesium	Manganese	Chromium	S. A. E. No.	Tensile Strength P. S. I.	Yield Strength P. S. I.	Elongation 2 in. Per Cent	Hardness*	Fatigue Limit, P. S. I. 500 x 106 Cycles Roversed Rending
Cylinder heads, pistons, bearings. Exhaust equipment. Exhaust valve guides	93	4 83	10	3		10	2.0 70 4	1.5		15	39 NF-14	32,000 80,000	18,000 30,000	1 25	95	8,000
Pistons	91 85 84	4.0 1.0 1.0			12.0		2.0 1.0 2.0	1.0			NF-2 NF-3 321	55,000 55,000 32,000	35,000 40,000 18,000	8 5	95 100 100	14,000
Valve seats. Valve seats, propeller cones	10	81 79	5		14.0	2.5	97	1.0	3		NF-9 NF-11	85,000	10,000	3.5	200	

^{*} Brinell unless preceded by letter for appropriate Rockwell scale.

† Data from "Aircraft Engine Materials" by J. B. Johnson

tershafts. The former must have excellent wear resistance at the splined portion.

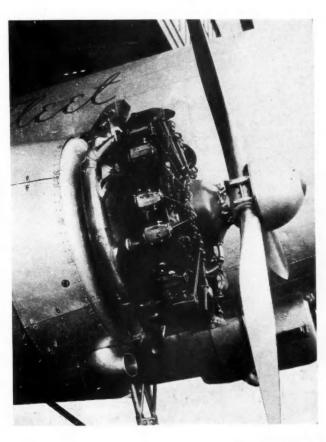
One of the most important applications of nickel alloy steels is to automotive gears. These members are subjected to very severe conditions, and the material used for rearaxle gears, especially, must provide high resistance to wear and fatigue. The transmission gears must resist shock and high tooth pressures, and experience has indicated that nickelalloy steels resist shock better than similar steels without nickel. Either the carburizing or the oil-hardening nickel-alloy steels may be used for transmission gears. The cost of the oil-hardening type is somewhat lower, but the carburizing type is tougher and has high wear-resistant qualities. Generally, the nickel-alloy carburizing-type steels find application in those parts which must withstand wear and have high strength or shock resistance. Some of the present uses include king pins, piston pins, steering gear and follower, roller-bearing parts, spring-shackle bolts, universal joints, steering-ball studs.

The austenitic nickel-chromium or nickel-chromium-silicon steels resist scaling and corrosion. They will perform satisfactorily at temperatures ranging as high as 1600 deg. Fahr. and may be repeatedly heated and cooled without ill effect. They are used for exhaust valves, where the steel must have high scaling and corrosion re-

sistance, in addition to strength and other steels are sometimes employed. hardness. Material for exhaust valves also must have good forging properties and hardness in the stem. The austenitic steels cannot be hardened by quenching and stems of

Nickel-alloy steels used for aircraft are listed on page 543. In general these steels fall into one or the other of two groups classified as the casehardening steels with carbon content

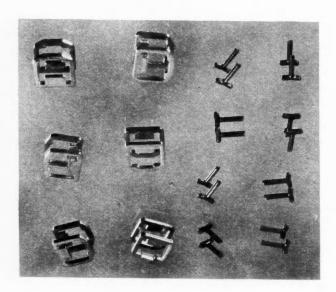
Inconel manifold and carburetor heater installed in one of the Douglas transport airplanes of East-ern Air Lines



Typical Alloys Containing Nickel Used in Engine Construction (Ferrous)

APPLICATION †		CHI	EMIC	AL CC	MPO	SITIO	ON		MECH	HANICAL PROPERTIES										
	Carbon	Manganese	Silicon	Nickel	Chromium	Tungsten	Molybdenum	Other Elements	S. A. E. No.	Tensile Strength P. S. I.	Yield Strength P. S. I.	Elongation 2 in. Per Cent	Red. Area							
Bolts, studs, nuts, shafts	0.30	0.65		3.50						125,000	100,000		50							
Connecting rods, gears	0.40			3.50	0.00					135,000	110,000		50							
Gears, piston pins	0.15	0.45		1.25					3115	130,000	90,000		40 50							
Bolts, studs, shafts	0.40	0.75		1.25					X-3140 3240	130,000 135,000	100,000 110,000		50							
Gears, pins	0.40			1.75	1.10					225,000	200,000		40							
Gears, cams, crankshaft	0.15			5.00	1.10				2515	170,000	145,000		45							
Gears, drive shafts, cams	0.12			3.50	1 50				3312	160,000	135,000		50							
Crankshaft, connecting rods	0.40			1 75	0.70		0 35		4340	160,000	140,000									
Exhaust manifolds, supercharger casing.	.07			7.0	17		0.00		30905	100,000	35,000									
Valves, inlet	0.30				12.5				Cr-Ni-Si	60,000*										
Valves, inlet and exhaust, supercharger buckets	0.45			14.0	14.0	2.5			Cr-Ni-W-Si											
Valves, exhaust	1.0	0.5	1.5	0.6	13.5		0.6		13.5 Cr	50,000*										

* Tensile strength at 1200 deg. Fahr.—All other tensile properties are typical specification values. † Data from "Aircraft Engine Materials" by J. B. Johnson



Monel metal cotter pins and yokes used in auand tomobile windwipers made by the Anderson Mfg. Co.

to 2 per cent the resulting material as cast is much more uniform in structure than plain cast iron. The alloying element serves to minimize occurrence of what are known as chill and hard spots in thin sections and at the corners and edges of a casting, thus improving machinability. The metal in thick sections of the casting is made relatively more dense, porosity is eliminated, and hardness, strength, and wearing qualities of the metal are increased. With certain compositions the heatand corrosion-resistance are appreciably improved.

Higher nickel additions to cast iron provide metals with even higher hardness and wear resistance. Relatively soft castings can also be pro-

less than 0.25 per cent, and the oiland water-hardening steels, which contain 0.30-0.70 per cent carbon. The former find application where a hard, wear-resistant surface is needed in combination with internal toughness or high shock resistance. The latter are frequently used for parts which are machined after being heat treated in order to get smooth, scale-free surfaces and accurate dimensions on the finished piece.

rollers, starter shafts, gears and cams, the case-hardened type is usually selected. For these, 5 per cent nickel, and the 1.5 per cent chromium-3.0 per cent nickel are used extensively. The oil-hardening type, with 3.5 per cent nickel, finds application for such parts as bolts, studs, connecting rods, rocker arms and small shafts.

Nickel Cast Iron

When nickel is alloyed with cast For aircraft parts such as valve iron in quantities ranging from 1



Electric Auto-Lite Co. uses cold rolled Monel strip metal for small rectangular pieces contact point inserts in distributor rotors

duced with high nickel content, and these can be heat treated after they are machined, to obtain high hardness, strength, and resistance to wear. Other alloy cast irons with high nickel content are excellent material for high-expansion castings sometimes used in conjunction with aluminum alloys. There are also in this group special heat- and corrosion-resistant alloys.

Among the advantages of nickel alloy iron are its relatively-low cost, the ease with which it can be cast into complicated shapes, good machining qualities, and the highly desirable properties of rigidity, strength and resistance to wear. The higher strength of nickel cast iron frequently facilitates weight reduction. Castings of nickel alloy iron are more accurate dimensionally than those cast of ordinary iron, and hence less machining is required, with consequent savings in production costs. The last-mentioned property sometimes permits additional saving, inasmuch as the weight of the castings as delivered from the foundry can be reduced.

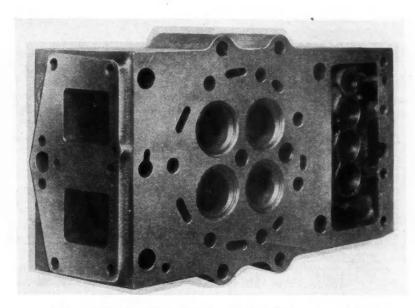
Some of the automotive parts for which nickel alloy iron is being used are cylinder blocks and heads, valve guides and seats, cylinder sleeves and liners, crankcases, flywheels, pistons and piston rings, brake drums, clutch pressure plate, and exhaust manifolds. More recent is the adop-

tion of this material for cast camshafts and crankshafts.

One of the earliest applications of nickel-alloy iron, dating about to 1920, was its use as material for cylinder blocks. Prior to the commercial adoption of the alloy for this purpose, much difficulty had been experienced with ordinary iron in castings in which section thicknesses varied greatly. In cylinder castings the

material was sometimes so porous the walls had to be made $\frac{1}{4}$ in. to $\frac{3}{8}$ in. thick to prevent leakage.

The wear-resisting, dense, and fine-grained nickel-alloy cast iron makes a very satisfactory material for cylinder blocks, its greater corrosion resistance being an added advantage. It permits increasing the hardness of thick sections without impairing the machinability of the



Winton Diesel head of nickel cast iron. This was produced by Allyne Ryan Foundry

Nickel Alloy Steels Used in Aircraft Engines

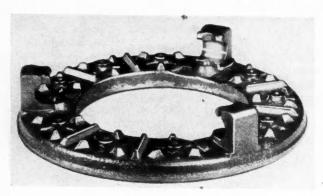
APPLICATIONS †	S.A.E. No.	Approximate Composition c/o
Piston pins, oil pump gears, accessory drive gears	2315	.15C 3.50Ni
Fuel and oil pump shafts, valve rockers, bolts	2330	.30C 3.50Ni
Cam rings, knuckle pins, cam and oil pump drive gears, cam shafts, crankshaft gears, Diesel crankshafts	2512	.12C 5.0Ni
Gear pins, piston pins, push rod ends, valve tappet rollers, cam rings, cam gears, Diesel wrist pins	3115	.15C 1.25Ni .60Cr
Studs and nuts, washers, master rods, crankshafts, oil pump drive gears, magneto and tachometer drive gears, tappets, rocker arms	3140	.40C 1.25Ni .60Cr
Magneto and oil pump gears, propeller hub cones, accessory drive shafts and starter gears	3340	.40C 3.50Ni 1.50Cr
Crankshaft and connecting rods, spiders; Diesel knuckle pins.	4345	.45C 1.75Ni .65Cr .35Mo

^{† &}quot;Nickel Steels and Alloys in Aircraft Engines", Aero Digest

relatively-thin sections.

Higher-nickel-content cast irons are employed for cylinder blocks of bus, truck, and tractor engines, which, if they are used without cylinder liners, should preferably show more than 200 Brinell in the cylinder bores. This is somewhat greater hardness than normally called for in the case of passenger-car engine blocks. Another advantage of nickelalloy cast iron, particularly important in this application, is that the castings have less tendency to warp as they cool in the mold. In the operation of the engine, the alternate heating and cooling of the metal tends to cause unevenly-distributed increase in volume, or growth, and nickel-alloy iron minimizes such

Mack Trucks, Inc., is said to have been one of the first motor-vehicle companies to adopt nickel-chromium alloy cast iron for cylinder blocks. The composition of the alloy used for Mack cylinder blocks has been reported as follows: Total carbon, 2.80-3.30 per cent; combined carbon, 0.55-0.80 per cent; manganese, 0.50-0.80 per



Nickel cast iron elutch pressure plate made by Borg - Warner Corp.

cent silicon, 1.72-2.25 per cent; nickel, 1.50-1.75 per cent; chromium, 0.50-0.75 per cent. The blocks are heat-treated in specially designed electric furnaces to relieve stresses. Properties of this alloy are as follows: Tensile strength, 38,000-40,000 lb. per sq. in.; average hardness, 229 Brinell. The blocks are said to be readily machinable.

Cylinder-head castings require metal that will withstand high compression pressures and high temperatures. In valve-in-head-type engines the cylinder-head material is also subject to the pounding action of the valves. These castings are frequently complex in shape and very thin in some sections. In general, the nickel alloy specifications for cylinder heads and cylinder blocks are the same. Nickel content ranges from 0.50 to 1.50, and chromium content from 0.20 to 0.50 per cent. Similar alloys are used for valve guides, in which wear resistance and corrosion-resistance are factors influencing the choice of material.

Nickel-alloy cast iron is used for separately-cast valve-seat inserts which must have high heat resistance and withstand deformation and scoring. The insert metal must also have the same coefficient of expansion as the block or head metal, and for this reason austenitic iron inserts are used in aluminum cylinder heads and blocks.

Cylinder liners are coming into wider use in bus, truck, and tractor engines. Increasing severity of service conditions imposed on these engines has brought about a gradual increase in the hardness specification for cylinders.

Wet and dry liners are either sand cast or made by the centrifugal cast-Those made by the ing process. latter method are characterized by close grain and high surface hardness, although the liners may have to be annealed due to the chilling action that takes place if cast in the metal mold. Nickel has been found

to minimize the tendency of the iron to chill, and nickel-alloy iron cast by this process also has better wearing qualities than ordinary iron. With the sand-casting method it is possible to get closer control of quality of the casting. Liners can be heat-treated to enhance their wear resisting qualities, and the use of nickel in the iron whether as-cast or heat treated is an advantage, as shown by the table below.

alloy are reported to have a service life which is two to four times greater than that of low-alloy or plain iron which has not been heat treated. One of the trade-named austenitic irons from which cylinder liners are sometimes made is called "Ni-Resist." Its analysis is as follows: Silicon, 1.25-2.00; total carbon, 2.60-3.00; sulfur, 0.04-0.12; phosphorus, 0.04-0.30; manganese, 0.80-1.30; nickel, 12.0-15.0; chromium, 2.00-3.50; copper, 5.00-7.00. This alloy has a tensile strength of 25,000-30,-000 lb. per sq. in. and a hardness of 150-200 Brinell.

Nickel-alloy irons, as previously mentioned, find favor as material for clutch pressure plates. Clutch plates require material with high resistance to wear and scoring, and fairly high strength and stability at elevated temperatures are also necessary. The nickel-alloy irons meet these requirements, and they have an additional advantage where plates are not machined all over, in that these cast irons facilitate production of cast-

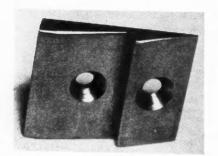
Typical Plain and Chromium Irons for Cylinder Liners

		Analysis		"As-Cast" Hardness	Hardness as Heat Treated
* Type of Iron	Sil.	Ni.	Cr.	Brinell	Brinell
Plain	2.25			180-210	296-311
Plain	1.75			210-230	340-360
Nickel-Chromium	1.76	1.13	0.45	250-270	470-490
Nickel-Chromium	1.13	1.21	0.39	260-290	490-510

* Harold L. Geiger in *Implement and Tractor*, June 12, 1937. All above analyses include 3.20 total carbon.

heat treated that their hardness will be maintained at engine-operating temperatures. Liners cast of nickel-

chromium or nickel-molybdenum iron



(Above) Automobile door lock striker plate milled from hot rolled Monel metal flat bars

(Right) Nickel alloy steel hub for Curtiss adjustable pitch propeller

It is essential that liners be so ings which are accurate in comparison with the original pattern, so that balancing of the plates can be accomplished with a minimum amount of machining. For exhaust manifolds, the nickel-alloy irons commend themselves because they will resist the corrosive influences of hot exhaust gases and can be readily poured in thin sections. More piston rings are



being made of nickel-alloy irons as the conditions under which rings operate are becoming more severe.

Alloy cast iron brake drums have been common in the bus and truck fields for a good many years, and more recently they have come into extensive use also in the passengercar field. Research work on brake drums carried on by the Mack Mfg. Corp. and others revealed the excellence of nickel alloy cast iron for this purpose.

In commercial - vehicle operation the tendency has been continually toward higher speed and increased load capacity, both of which result in heavier demands on brakes, due to the increased braking pressures required. The adoption of tires of wider section also results in space limitations. Mack research disclosed that steel brake drums tend to score under the severe abrasive action to which they are subjected in modern operation and even to fuse in spots.

The first Mack drums to be made of high-test nickel iron were cast from an alloy containing 2.5 per cent nickel. These gave satisfactory results until operating conditions increased further in severity, then showed a tendency to score when extremely hot. The failures were attributed to quick stops, which called for the absorption of large amounts of energy in a short time. It was found that stabilizing hot hardness by reducing the silicon content of the alloy and introducing chromium in addition to nickel prevented scor-(Turn to page 555, please)

Automotive Materials

Tantaloy For "Flowed-On" Cutting Tools

Tantaloy, a hard tantalum carbide cutting metal announced a short time ago by Fansteel Metallurgical Corp., is reported to facilitate a new technique and a new method of making tools for steel cutting. Strength, coupled with high resistance to abrasion and "cratering," makes it practical to use very thin tips on cutting tools. This brings the steel shanks sufficiently close to the tip so that heat is carried away rapidly and effectively. In machining steel, Tantaloy tips 1/16 in. to $\frac{1}{8}$ in. thick are said to perform better than thicker tips.

It has been found that the making of thin-tip tools is more readily accomplished by applying the hard metal in bar form with an acetylene torch, rather than the conventional method of brazing. In making flowedon tools, the shank is recessed by milling or grinding. Ordinary carbon steel may be used, or Tantaloy may be applied to high speed steel tools which have worn undersize. After the Tantaloy is sweated on, the tool is ground and ready for service. No hardening or tempering is necessary.

Developments in Automotive Rubbers

Developments in rubber which have been responsible for the use of more and more dense and sponge rubber products for cushioning, insulation, seals, noise and vibration dampening in the automotive vehicle were discussed recently by H. A.

NEW DEVELOPMENTS

a paper presented at a convention of the Rubber Division of the American Chemical Society in Detroit.

Sponge rubber has been given a great deal of attention and in addition to the standard types of molded and heater cured sponge rubber. there have been developed sponge rubbers expanded with carbon dioxide and nitrogen gas, as well as Latex sponge. Heat-resisting sponge rubber is also now a standard product.

Deterioration due to aging on oxidation is the limiting factor in the serviceability of a rubber product and, as Mr. Winkelmann asserts, the type of aging which a product meets in service should have a bearing on the type of accelerated aging test which is prescribed. It is possible to use an accelerated aging test which is so severe that it introduces other oxidation factors and does not truly interpret the aging characteristics of the product in service.

The use of a wax which will bloom to the surface and give a protective coating is the most effective means of preventing deterioration such as checking or cracking. And, while the importance of the composition and source of the wax are not known, it is definitely established that its solubility in rubber is very important. In fact, solubility in rubber should be quite low over the normal

Winkelmann, Dryden Rubber Co., in temperature range so that it will constantly bloom to the surface. As a rule, a wax having amorphous and not crystalline characteristics gives the best results.

> The use of internal mixers and plasticators has resulted in economies in time and equipment. However, the increased speed of mixing has resulted in dispersion problems with many compounding ingredients and the use of special equipment to facilitate cooling of stocks to avoid partial set-up.

> Manufacture of extruded rubber products such as strip and tubing requires a stock that is smooth and free of all lumps and foreign matter. At present, it is necessary to refine such stocks by straining and refining before extrusion. In some instances only, the rubber is strained; in others, the compound, minus the sulfur, is strained.

> Softening of crude rubber has been accomplished by the use of small amounts of naphthyl-beta-mercaptan. The mastication and mixing time is decreased and the processing properties of the rubber compounds are improved. This softening action of naphthyl-beta-mercaptan is not reflected in the vulcanized product. Apparently there is need for a softening or peptizing material, effective in small amounts, that will result in softer stocks after vulcanization. It

(Turn to page 553, please)

Just Among urselves

One Week in April

BOUT 10 days from the date of this issue, the National Automobile Dealers' Association will be holding a meeting in Detroit. This will be the first general meeting of dealers since the Withrow hearings in Washington, and unquestionably the meeting will have important bearing on the future activities of dealers in seeking legislative or other remedies for their grievances. Concurrently in Detroit will be held a Fair Trade Practice Conference under the auspices of the Federal Trade Commission.

In Washington, on the President's desk, lies ready for signing, a copy of the Withrow-Minton resolution authorizing the F.T.C. to spend \$50,000 on a sweeping investigation of the automobile industry as a potential monopoly.

We have a feeling that final action on many cases now pending will be influenced largely by the result of discussions, testimony, procedure, and all the other phases of automotive activity during that week.

One of the paramount issues is the possibility of establishing a junking plan financed by factories and dealers. Another will undoubtedly be the possibility of contract concessions from automobile manufacturers who have not yet publicly announced them.

There is the possibility that the President's desire to sign the bill authorizing an F.T.C. investigation will hinge somewhat on the relative resistance in factory attitudes before the meetings in Detroit. The week will be worth watching in all the ways that it may affect your business, both directly and indirectly.

HERBERT HOSKING.

Stock Rear Axles-61 Models

are available for Automotive needs in 1938 season

OR 1938 there are available on the American market 42 models of rear axle designed for use on trucks, twelve intended for passenger cars, two suitable for both passenger cars and light trucks, and five suitable for both trucks and buses. Only three of the five manufacturers whose products are listed in the accompanying table give load (on spring pads) and drive-shaft torque ratings. rated load capacities of the automobile rear axles range between 1400 and 5000 lb., those of the truck axles between 3000 and 24,000 lb. The rated torque capacities of the passenger-car axles vary from 600 to 2500 lb-ft. in the case of passenger car axles and from 450 to 2416 lb-ft. in the case of truck axles.

It is interesting to note that all of the four manufacturers who specialize in truck axles use the fullfloating construction, whereas the two that make rear axles for passenger cars use the semi-floating type, except that one also has two three-quarter floating axles for passenger cars. It may be recalled that in a semi-floating axle the load overhangs the bearing at the outer end of the axle, whereas in a threequarter floating axle the wheel load is taken directly on the bearing at the outer end, which is mounted on the outside of the axle tube, the hub being secured rigidly to the axle shaft.

Final Drive

Of the twelve passenger-car rear axles listed, seven have spiral bevel and five hypoid final-drive gears. Of the 42 axle models for trucks, 24 have spiral-bevel-gear final drives, thirteen have double-reduction final drives, and five worm drives. In the table, five axles are listed as having internal-gear final drives; these, however, are not the conventional internal gear drives with an internally toothed ring gear secured to the wheel, with which meshes a pinion at the end of a drive shaft extending parallel with but outside the axle housing. The

internal gears in this case are in- the differential end they are usually corporated in a two-speed gear combined with the differential, which makes the axle a two-speed axle. When operating in the higher speed range, the two-speed gear is idle and the drive is direct through the spiral bevel gears on the differential, whereas when operating in the low-speed range the first reduction is through the spiral bevel gears and the final reduction through the internal-gear type of planetary assembly. The five axles that are offered for both trucks and buses all have the conventional double-reduction final drives (first reduction by spiral bevels, second by spur or herringbone gears).

Gear Materials

It is obvious from the table that the molybdenum case-hardening steels are by far the most popular for rear-axle gears. Both the 4600 and the 4800 series (medium nickel and high-nickel alloys) are in use, though the former predominates. Next in popularity are the nickel steels, of which both the moderate and the high-nickel types are represented. These steels, moreover, are used in the form of oil-hardening as well as case-hardening steels.

Two of the passenger car axles listed have overdrives incorporated in them, and with the overdrives effective the reduction ratios between engine and road wheels are 3.10 and 3.25. Disregarding these overdrives, the reduction ratios in the passenger-car axles range from 4.30 to 4.60. Reduction ratios of truck axles of the single-reduction type range from 4.87 to 10, and even to 11.87, if the optional ratios are included.

Axle shafts of full-floating rear axles always are larger in diameter at the differential than at the wheel end. This is due to the fact that at

upset where the splines are cut for the driving connection with the differential side gears. At the wheel end these shafts usually are forged with integral driving flanges. Shafts of the semi-floating axles, on the other hand, are usually considerably larger in diameter inside the wheel bearing than at the differential end, because these shafts are subject to combined torsion and bending stresses, and the bending moment is greatest inside the bearing at the wheel end.

The most popular steels for rearaxle shafts are chromium-molybdenum and nickel-chromium-molybdenum steels of the medium-carbon type (usually 40 points carbon). Chrome-nickel steels are used to a limited extent.

Only one maker of passenger-car axles gives information on springcenter limitations. In his case the maximum spring-center distance is 46 in.; the minimum, 40 in. It is a rather interesting point that the maximum spring-center distance is considerably greater with the passenger-car than with the truck axles. This, of course, is due to the fact that in trucks both the tires and the springs are much wider, and most trucks even have dual rear tires; and as the over-all width of road vehicles is limited by law and the maximum spring-center distance is substantially the difference between the maximum permissible vehicle width and the combined width of all rear-axle tires plus the width of the spring on one side, the maximum possible spring center distance comes out less in the case of the truck.

Both the torque reaction and the driving thrust can be taken on the springs in every one of the axles listed. In other words, all axles are designed for Hotchkiss drive. However, in the case of two makes, provision is made on some of the modbus or truck manufacturer, if he so desires, can relieve the rear springs of the driving thrust. In 17 of the below the axle housing, in seven they can be either above or below, and in the remaining 37 they are above the housing.

els for fitting radius rods, so the part produce their own differen- axles and axles for light trucks, tials. One manufacturer of passen- while four pinions are used in all ger-car axles gets his differentials of the heavier axles. from a specialist, while a manufacaxles listed the spring pads are turer of truck axles gets the differentials for his two largest axle models from outside. The bevelgear type of differential is in universal use. The two-pinion type nish brakes with most of his axle

Axle manufacturers for the most holds the field in passenger-car

Brake practice is quite varied. Only one maker (of truck axles) equips all of his axles with brakes of his own manufacture. A maker of passenger-car axles does not fur-

AMERICAN STOCK

		u ₀	Shaft -Ft.)				AR MA		LS		GEA	R RAT	10		NOM: PITCI GEA	H OF	FACE GEA		AX	LE SH	AFT
MAKE AND MODEL	First Final					First Final Reduction					tion	tion	tion	tion	Differential	Wheel	S.A.E. No.				
1	Designed fo	Recommended I Spring Pads (Lb	Recommend Torque Cap	Туре	Final Drive	Pinion	Gear	Pinion	Gear	Standard	Optional	Optional	Standard	Optional	First Reduction	Final Reduction	First Reduction	Final Reduction	Diam. at Di End (In.)	Diameter at End (In.)	Material
lark R-650 lark R-651 lark R-750 ark R-950 lark R-1100 lark R-1300 lark B-805	Trucks Trucks Trucks Trucks Trucks Trucks Trucks Trucks	†† †† †† †† †† ††	†† †† †† †† ††	FF FF FF FF FF	SB SB SB SB SB SB	4815 4815 4815 4815 4815 4815 4815	4620 4620 4620 4620 4620 4620 4815			5.14 5.14 5.57 5.57 6.33 7.16 7.16	4.50 4.62 5.12 6.33 5.57 6.42 5.75	5.57 5.40 6.33 6.83 6.83 6.83			3.13 3.13 3.18 3.00 2.76 2.81 2.81		1.50 1.50 1.62 1.87 2.00 2.06 2.12	******	1.50 1.50 1.62 1.75 1.87 2.00 2.12	1.37 1.37 1.37 1.50 1.56 1.68	Am Am Am Am 324 X314
olumbia 200A olumbia 800A olumbia 17000A olumbia 38000A olumbia 10000A	Cars Cars Cars Cars Cars	2500 3000 5000 2500	1800 2500 2500 1800	3/4 F 1/2 F 1/2 F 3/4 F 1/2 F	Hy** SB** SB Hy SB	4615 4615 4615 4615 4615	4615 4615 4615 4615 4615			4.30(x) 4.30(z) 4.50 4.60 4.60					4.46 4.20 4.70 4.90 4.40		1.25 1.37 1.31 1.62 1.18		1.18 1.31 1.31 1.43 1.18	1.37 1.50 1.50 1.50 1.37	414 414 414 414
Acton D-15 Acton 16000 Acton 13000 Acton 1280 Acton 2650 Acton 18000 Acton 18000 Acton 17000 Acton 17000 Acton 2700 Acton 2700 Acton 2700 Acton 2700 Acton 2700 Acton 17600 Acton 17600 Acton 17600 Acton 17600 Acton 17600	Trucks	4500 10700 10800 9300 15000 18000 18650 24000 17500 12000	450 1350 1150 1050 1750 1750 1750 1750 1950 1600 1400	FF FF FF FF	SB Int* Int* Int* DR SB Int* DR DR SB SB	2512 2512 2512 2512 2512 2512 2512 2512	2315 4620 4620 4620 2315 2320 4620 4620 2512 2315 2320 2320	2340 2340 2340 2512 2350 2350 2512 2512	4620 4620 2315 4620 4620 4620 2315 2315	4.87 5.62 5.14 5.14 1.92 6.43 6.43 2.33 2.18 6.43 6.43	5.28 6.14 5.83 5.83 2.18 5.62 5.62 5.62 2.08 1.92	2.55 7.16	1.38§ 1.39§ 3.69 1.36§ 1.36§ 2.73 3.69	3.84	3.61 3.18 2.96 2.96 3.00 3.00 3.00 2.40 2.66 2.95 2.95	6.5-8.5 7-9 7-9 4.00 6-8 6-8 3.50 4.00	1.25 1.87 1.68 1.68 1.75 1.87 2.00 2.00 2.00 1.87 2.12 2.12	1.75 1.50 1.50 3.31 1.75 1.75 4.00 3.75	1.37 1.87 1.75 1.75 2.12 2.00 2.00 2.00 2.62 2.25 2.12 2.00	1.12 1.68 1.50 1.50 1.75 1.75 1.75 2.28 2.01 1.90 1.75	414 324 414 414
Salisbury 10 Salisbury 21-1 Salisbury 31-2 Salisbury 41-2 Salisbury 44-5 Salisbury 42-5 Salisbury 55 Salisbury 51-3 Salisbury 51-5 Salisbury 51-5 Salisbury 51-5	C, T C, T Cars Cars Cars Cars Cars Trucks Cars	†1400 †2200 †2200 †2200 †2000 †2500 †3000 †3000	1920 1920 2250 2416 2416	FF F	SB SB SB Hy SB Hy SB Hy	4615-1 4618-1 4618-1 4618-1 4618-1	4618-1 4615-1 4618-1 4618-1 4618-1 4618-1 4618-1			Var Var Var Var Var Var Var Var Var	Var Var Var Var Var Var Var Var Var				Var Var Var Var Var Var Var Var Var		1.00 1.25 1.25 1.28 1.28 1.28 1.44 1.41 1.41		1.00 1.12 1.22 1.22 1.22 1.22 1.31 1.31 1.31	1.00 1.37 1.50 1.37 1.37 1.37 1.56 1.18 1.65 1.56	414 414 414 414 414 414 414 414
Timken 5330 Timken 5330 Timken 5330 Timken 5330 Timken 5330 Timken 5441 Timken 5641 Timken 5830 Timken 6480 Timken 6480 Timken 6520 Timken 6572 Timken 6872 Timken 6872 Timken 7344 Timken 7741 Timken 7573 Timken 7631 Timken 7631 Timken 7631 Timken 7631 Timken 7631 Timken 7933 Timken 7933 Timken 7933 Timken 7933 Timken 9344 Timken 9344 Timken 9441	3 Trucks 1 Trucks 1 Trucks 1 Trucks 0 Trucks 0 Trucks 0 Trucks 5 Trucks 5 Trucks 6 Trucks 6 Trucks 1 Trucks	1	†† †† ††	444444444444444444444444444444444444444	SB SB SB SB SB SB Wo Wo DR DR DR DR DR DR (b	4820 4820	4620 4620 4620 4620 4620 4620 4620 4620	4620 4615 4324 4615 4324 4324 4620 4620 4820	4615 4620 4620 4620 4620 4620 4620 4620	2.25 1.91 2.22 2.06 2.37 2.33 2.77	6.80 6.83 5.57 6.40 6.75 6.80 6.80 11.75	7.75 10.25 8.75	7.35 7.35 9.41 7.35 9.20 9.48 10.12 5.64 5.57 6.19	8.16 7.62 8.18	9.12 9.50 10.00 11.00 d 4.75 d 8.00 d 9.25	a 10.75a a 12.55a a 14.34a a 15.93a a 16.92a a 10.25a a 10.25a a 11.03a	1.87 2.25 2.25 2.37 1.75 1.75	3.50 3.75 4.50 4.50 2.00 2.25 2.37	2.66 2.95 1.75 1.75 1.87	1.56	4: 4: 4: 4: 3:
Wisconsin 5000- Wisconsin 72300- Wisconsin 1337-BI Wisconsin 1757-V Wisconsin 1910-V	H T, Bu H T, Bu N T, Bu	Var Var Var Var	Var Var Var Var Var	FF FF FF	DR DR DR DR	4820 4820 4820 4820 4820	4820 4820 4820	4620 4620 4620	4620 4620 4620	1.80 2.10 1.90	2.10		6.62 7.35 6.36 8.50 8.88	7.35 6.49 7.27 9.20 10.00	2.40 2.50 2.40	3-4 3-4 5.0(H	1.75 2.25 2.25 2.50 2.50	2.75 2.75 3.75	2.06 2.25 2.50		. 3

ABBREVIATIONS:

^{••-} With Planetary Overdrive

^{°-}Others also †-Nominal Load on Tires

^{††—}Recommendations of axle sizes are made only after complete specifications have been sub-mitted by vehicle manufac-tures.

turer §—Ratio of planetary assembly.

^{*—}Two-speed axle, with internal-gear type planetary assembly. ‡—Less brakes and wheels ‡—Semi Floating ‡—Three Quarters Floating (a)—Nomina: Pitch Diameter of Gears

AA—Above axle
AB—Above or below axle
Amo—Amola Steel
(b)—Two Speed
B-R—Ball and Roller Bearings

BA—Below axle Ben—Bendix —Buses —High Speed -Cars

leave the choice of the brake to the customer in connection with practically all of their axles. Brake diameters and widths of lining are given widths of lining between 2 in. and for the majority of axles, and these 5.5 in. are perhaps the best index of car-

models, while two manufacturers eter and width of lining should be are found in every possible posisubstantially proportional to the carrying capacity. Brake diameters vary between 133% and 21 in., and

Anti-friction bearings are used rying capacity where no figures for exclusively on all power shafts of limiting load on spring pads are the axles, and the roller type pregiven, as the product of brake diam-dominates. Ball bearings, however, 79 in.

tion on some axles. The materials used for axle housings include malleable iron, cast steel, low-carbon steel, and medium-carbon steel, the latter being used in the heat-treated condition.

Track widths start at just below 60 in. and extend up to practically

REAR AXLES

ANGE SPRII ENTI	NG				Rods	e l	Diffe	erenti	ial		SERV	ICE BR	AKE			TYPE (OF BEA	RINGS			Size (In.)			ation	
		- hy		iken by	Radius	Spring Pads			Pinions			Drum	Lini	ng	uo	ion	-		Shaft	Material bers	Tire		~	ed Lubrication	MAKE AND MODEL
Maximum	Minimum	Torona takan	outer onthing	Propulsion taken	Provision for	Location of S	Make	Type	Number of F	Make	Type	Diameter of (In.):	Width	Thickness	First Reduction Pinion	Final Reduction Pinion	At Differential	At Wheels	On Pinion St	Axle Housing S. A. E. Numb	Minimum Ros With Regular	Track (In.)	Weight (Lbs.	Recommended	
6.87 9.50 9.50 9.50 9.50 1.00	39.00	Sp Sp Sp Sp Sp O Sp	0,01010101	Sp Sp Sp Sp	No No No No No No	BA AA AA AA AB AB	Own Own Own Own Own Fair Fair	8 8 8 8 8 8	2 2 2 4 4 4 4	Own Own Own Own Own Own Own	H H H H H H H H H H H H H H H H H H H	14 15 ¹ / ₄ 15 ¹ / ₄ 16 ¹ / ₄ 16 ¹ / ₄ 17 ¹ / ₄ 17 ¹ / ₄	2.00 2.25 2.25 2.50 3.50 4.00 4.00	.312	B-R B-R Roller Roller Roller Roller		Roller Roller Roller Roller Roller Roller Roller	Roller Roller Roller Roller Roller Roller	Roller Roller Roller	1035HT 1035HT 1035HT 1035HT 1035HT CS CS	6 13-28 834-32 81-32 834-34 934-36 836-36 914-38	595/8 605/8 63 65 671/2 701/4 693/4	240 270 284 354 447 621 634		Clark R-65 Clark R-75 Clark R-77 Clark R-91 Clark R-110 Clark R-13 Clark R-18 Clark R-18
8.00 6.00 6.00 6.00	40.0 40.0 40.0 40.0	O Sp O Sp		Sp Sp Sp	No No No No No	BA BA BA BA	War War War War	8888	2 2 2	NBF NBF NBF Wag NBF	İH	133/8	2.00	.375	Roller Roller Roller Roller Roller		Roller Roller Roller Roller Roller	Roller Roller Roller Roller Roller	Roller Roller Roller Roller Roller	1010 1010 1010 1010 1010		62 62 62 61 62		EP EP EP	Columbia 200 Columbia 800 Columbia 17000 Columbia 38000 Columbia 10000
1.50 9.50 9.50 0.00 0.12 9.50 9.50 9.50 10.00 10.12 10.00		SI SI SI SI SI SI SI SI SI SI SI SI SI S	o i	Sp Sp Sp Sp Sp Sp Sp Sp Sp Sp Sp	No No No No No No No No No No	BA AA AA AA AA AA AA	Own Own Own Own Own Own Own Own Own	888888	2 4 4 4 4 4 4 4 4 4	Ben Cla Wag Wag Ben Wag Wag Wag	IH IH IH IH IH IH Air Air	14 1614 1614 1614 17 1714 1714 1714 1714	2.00 3.50 3.50 4.00 5.00 4.00 5.50 5.50 4.00 3.00	.250 .375 .375 .375 .375 .375 .375 .750 .750 .375 .375	Roller Roller Roller Roller Roller Roller Roller Ball Roller Roller	Roller Bali Roller	Roller Roller Roller Roller Roller Roller Roller Ball Roller Roller Roller	Roller Roller Roller Roller Roller Roller Roller Roller Roller Roller	Roller Roller Roller Roller Roller Ball Roller Roller	MI MI MI MI MI MI MI MI MI MI MI MI	678-29 914-361 938-361 914-361 101-391 11-41 110-391 1112-45 1112-45 1114-41 101-391 912-38	64% 67% 67% 67% 65% 71% 70% 70% 71% 71% 71% 69%	267 485 753 1534 1110 866 761	EP EP EP EP EP EP EP EP EP	Eaton D- Eaton 160 Eaton 13 Eaton 12 Eaton 26 Eaton 18 Eaton 170 Eaton 81 Eaton 27 Eaton 25 Eaton 15 Eaton 17
ar lar lar lar lar lar lar lar	Var Var Var Var Var Var Var Var	S		Sp Sp Sp Sp Sp Sp Sp Sp Sp	No No No No No No No No No	BA BA BA BA BA BA BA	Own Own Own Own Own Own Own Own	8888888	2222222222222	Var Var Var	Var Var Var Var Var Var Var Var Var	Var Var Var Var Var Var Var Var Var	Var Var Var Var Var Var Var Var	Var Var Var Var Var Var Var Var	Roller Roller Roller Roller		Roller Roller Roller Roller Roller Roller Roller Roller Roller	Roller Roller Ball Roller Roller Roller Ball	Roller Roller Roller Roller Roller Roller Roller	1020 1020 1020 1020 1020 1020 1020 1035 1020 1020	Var Var Var Var Var Var Var Var	Var Var Var Var Var Var Var Var Var	163 1103 1115 1122 1116 1116 1146 1155 1150	Oil Oil EP Oil Oil Oil Oil	Salisbury 2 Salisbury 2 Salisbury 3 Salisbury 4 Salisbury 4 Salisbury 5 Salisbury 5 Salisbury 5 Salisbury 5 Salisbury 5 Salisbury 5
41.00 41.00 41.00 41.00 42.00 41.00 41.00 41.00 41.00 41.00 41.00 41.00 41.00 41.00 41.00 41.00 41.00 41.00	39. 39. 39. 39. 39. 39. 39. 39. 39. 39.	00 S 00 S 00 S 00 S 00 S 00 S 00 S 00 S		\$	No Yes No No Yes	AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA	Own Own Owr Owr Owr Own Own Own Own Own Own Own Own Own Own		444444444444444444444444444444444444444	Opt	Opt	Opt 16 14 16 16 17 14 17 14 17 14 16 16 16 16 16 16 16 16 16 16 16 16 16	Opt 2.25 2.00 2.25 Opt Opt 4.00 3.50 4.00 5.00 Opt 2.25 Opt Opt 5.50 5.50 5.50 5.50 5.50 2.25 Opt 3.50	.750 .312 Opt	Roller Roller Roller Roller Roller Roller Roller Rollel Ro	Roller Roller Roller Roller Roller Roller Roller Roller	Roller Ball Ball Ball Ball Ball Roller Rolle	Roller Roller Roller Roller Roller Roller Roller Roller Roller Rolle Rolle Rolle Rolle Rolle Rolle Rolle Rolle Rolle Rolle Roller Rolle	Roller	MI 1010 1010 1010 MI 1010 1010 1010 1010		65 65 64 65 69 69 72 72 65 65 70 69 72 72 72 75 65 65 65 65 65 65 65 65 65 65 65 65 65	4444488		Timken 533 Timken 533 Timken 533 Timken 535 Timken 544 Timken 544 Timken 564 Timken 644 Timken 655 Timken 665 Timken 665 Timken 666 Timken 73 Timken 74 Timken 75 Timken 75 Timken 75 Timken 75 Timken 76 Timken 79
41.00 41.00 41.50 41.00 41.00	0 37. 0 36. 0 39.	00 00 00 00 00 00	Sp Sp Sp	Sp Sp Sp Sp	Ye Ye Ye Ye	s Al	Own	n B n B	1		t Air	16 1714 1714 1714	5.00	.375 .312 .750	Rolle Rolle Rolle	r Rolle	r Ball r Ball r Rolle	Rolle Rolle Rolle Rolle Rolle	r Rolle r Rolle r Rolle	MI MI	11-36 12-38 11-38 11½-4 12½-4	66 69 69 71 10 71	780 981 1271 152 152 156	Oil Oil	Wisconsin 500 Wisconsin 7230 Wisconsin 1337 Wisconsin 175 Wisconsin 191

CS-Cast Steel

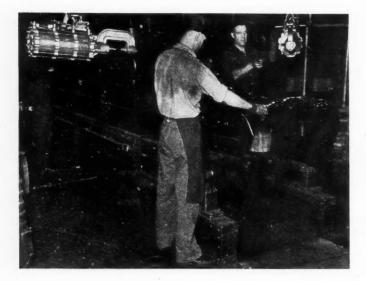
Cla—Clark CS—Cas (d)—Low Speed DR—Double Reduction EP—Extreme Pressure FF—Full Floating

Fair—Fairfield H—Herringbone HT—Heat Treated Hy—Hypoid IH—Internal Hydraulic Int—Internal Gear Lock—Lockheed MI—Malleable Iron

NBF—No brakes furnished O-EP—Oil or Extreme Pressure Opt—Optional SB—Spiral Bevel Sp—Springs

T—Trucks
Var—Various or Variable
Wag—Wagner
War—Warren Gear
West—Westinghouse

Wis-Wisconsin Wo-Worm (x) -With 3.10 Overdrive (z)-With 3.25 Overdrive



Production Lines

Here the Pontiac chassis frames are swung onto the line to begin their long journey which ends more than a quarter of a mile away

Conveyor Shafts

Centrifugally cast conveyor shafts of heat-resistant alloy steel have reduced expense and helped to increase production in many plants. For this reason high-chromium steel is being used for roller shafts that convey steel sheets to heat-treating furnaces.

Dry shafts of high-chromium steel have several obvious advantages over water-cooled insulated shafts made from metals that are not so heat-resistant. In the first place, they retain their strength at elevated temperatures, and for this reason smaller shafts can be used. Too, they will operate at temperatures up to 2,000 deg. Fahr., provided they are kept rotating at temperatures above 1,000 deg. Fahr.

Body Tooling

At a recent session of Detroit Section, SAE, Frank Coates, production engineer, Fisher Body, noted that the 1938 Chevrolet body required 1,152 dies. Die cost in a major bodybuilding program represents about 65 per cent of the entire cost of tooling a body program, according to Mr. Coates. In Chevrolet production, the dies will normally process around 2,500 tons of steel per day.

Sleeve Valve

Browsing in one of the prominent automotive research labs recently, we saw a new sleeve valve engine of unique design. Object is to put it

through its paces in an outside organization. We don't know the name of the builder, but if the job pans out we'll all hear about it.

13 Cover World

A friend who is an outstanding mathematician has just developed a system of angle blocks having a remarkable range of application. The set of blocks consists of only 13 pieces, of which never more than ten need be used. It is claimed that combinations of the 13 blocks make possible the construction of 83,520 different angles, ranging from 0 to 116 degrees in intervals of 5 seconds. The gage blocks are said to be accurate to within 0.00001 in., so that the total error of any set-up can't exceed 0.0001 in. If you are interested, we shall be glad to put you in touch with the inventor.

Milling Practice

Section of the new Kent's Mechanical Engineers' Handbook, devoted to milling machine practice has been reprinted in booklet form by The Cincinnati Milling Machine Co., whose experts, Hans Ernst and Mario Martelotti, prepared the material for Kent. This little 16-page booklet contains much interesting information on current milling practice, touching in particular on a comparison of the conventional up-cut and the climb milling process so much discussed recently. Call on us if you want a copy for your personal use.

Instrumentation

As time goes on most research men realize that instrumentation is the most valuable adjunct to good results both in the laboratory and in the commercial field. Indicating and recording instruments of an amazing variety are available today but much of it still is confined to the research field. The time has come, without question, when the formal engineering course must include some work specifically on instruments and their use. More important still, means must be found for acquainting practicing engineers and research men with the latest available information extant today.

True Precision

One of largest tractor manufacturers is adopting the use of precision con rods for its line of Diesel engines. Part of the program is precise alignment of precision bearing shells by unique operations on the con rod bolt holes. These are precision-bored after drilling, then broached to eliminate all tool marks. It is felt that these operations are most essential to bearing alignment on the heavy duty rods intended for Diesel service.

Lube Test

Prominent cutting fluid manufacturer is making it his business to educate the customer in the most efficient use of the product. And few do a better job. Latest wrinkle is development of a novel burette made from a transparent molded plastic. It will be supplied to friends of the house. The idea is that you pour in some soluble oil from the machine tank, add dilute sulfuric acid, then read the percentage dilution directly in terms of so many parts water to one part oil. It's simple, but it will go far to explain corrosion troubles. machinability troubles, and the host of other problems involved in the use of cutting fluids.

Supercharging -

Its effect on engine power and fuel economy is investigated in a series of tests

RICHARD B. SNEED of Ethyl Gasoline Corp., in a paper presented at the SAE National Passenger Car Meeting in Detroit, gave the results of a research on the effects of supercharging automotive

with atmospheric induction, for three fuels of different octane numbers. The lower compression ratio was obtained by placing a copper gasket under the cylinder head.

Intake-manifold depressions of the

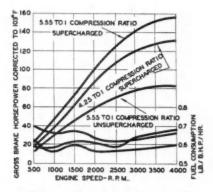


Fig. 1—Horsepower and fuelconsumption curves with and without supercharger. (No deduction made for power required to drive supercharger)

Table I

Intake Manifold Depression and Total Boost When a Manifold Pressure of 10 Inches of Mercury Above Atmospheric Was Maintained at All Speeds

to 1	4.25 to 1 Compres-	Inches of 5.55 to 1	Mercury 4.25 to 1
Ratio		Compres- sion Ratio	Compres- sion Ratio
17	0.17	10.17	10.17
50	0.45	10.50	10.45
.90	0.90	10.90	10.90
40	1.40	11.40	11.40
.00	1.85	12.00	11.85
60	2.45	12.60	12.45
20	2.80	13.20	12.80
.50	****	13.50	
	17 50 90 40 00 60 20	17 0.17 50 0.45 90 0.90 40 1.40 00 1.85 60 2.45 20 2.80	17 0.17 10.17 50 0.45 10.50 90 0.90 10.90 40 1.40 11.40 00 1.85 12.00 60 2.45 12.60 20 2.80 13.20

engines. The experimental work was done on an eight-cylinder, valve-inhead, 233-cu. in. stock engine and covered three phases, as follows:

- Dynamometer tests with air supplied by a separately-driven compressor.
- Dynamometer tests with supercharger driven from test engine.
- 3. Road tests with supercharger driven by test engine.

Two compression ratios were used in the tests of the first phase, viz., the standard ratio of 5.55, and a low ratio of 4.25, with which latter, in combination with a manifold pressure of 10 in. of mercury, the speeds of incipient knock were the same as with the standard compression ratio

unsupercharged engine at full throttle varied with speed as shown in Table I. The effective boost on the engine when supercharged, at any given speed, was equal to the sum of the amount by which the inlet-manifold pressure exceeded atmospheric (10 in. of mercury) and the corresponding manifold depression for the engine when it was operated unsupercharged at full throttle at the same speed. Thus at 4000 r.p.m. the boost on the engine with 5.55 compression ratio, when supercharged to an intake-manifold pressure of 10 in., was 13.5 in. of mercury.

Fig. 1 shows the power output and specific fuel consumption of the engine both unsupercharged and supercharged to 10 in. mercury, at vari-

ous speeds. Similar curves are shown for the 4.25 compression-ratio engine supercharged to 10 in. of mercury. These data were obtained at maximum-power air-fuel ratio and maximum-power spark advance. The same fuel of approximately 78 octane number was required for the 4.25 compression ratio with supercharging as for the 5.55 compression ratio without boost, yet the power output with boost was 63 per cent greater. The 5.55 compression ratio with

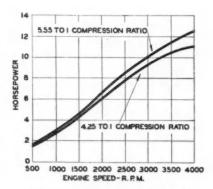


Fig. 2—Power required by supercharger (calculated)

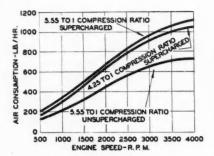


Fig. 3—Air consumption of 233-cu. in. engine under different conditions

boost, requiring approximately a 90 octane-number fuel, showed a power increase of 96 per cent over the engine unsupercharged with the same compression ratio.

In applying the test data to an installation with the supercharger driven by the engine, the power to be charged to the blower and subtracted from the engine brake power was calculated from the following adiabatic air horsepower formula:

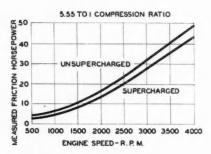


Fig. 4—Motoring horsepower of 233-cu. in. engine

$$\begin{aligned} & \text{Horsepower} = \\ & \frac{144 \times n \times Q}{33000 \times (n-1) \times E} \ P_1 \\ & \left[\quad \left(\frac{P_2}{P_1} \right)^{\frac{n-1}{n}} - 1 \quad \right] \end{aligned}$$

where: *n* is the adiabatic exponent of compression, 1.4

- Q, the quantity of air handled by the blower, in cu. ft. per min. at atmospheric pressure.
- E, the adiabatic efficiency of blower (assumed to be 50 per cent)
- P₁, the supercharger inlet pressure in lb. p. sq. in., equal to atmospheric pressure less the pressure drop through the carburetor.
- P₂, the blower discharge pressure in lb. p. sq. in. (assumed to be equal to atmospheric pressure

plus the total boost pressure).

The calculated blower power is shown in Fig. 2. The differences in blower power requirement for the two compression ratios resulted from differences in actual air consumption, Fig. 3.

Fig. 4 shows the power required to motor the engine at the speed and intake-manifold pressure considered, with no supercharging and with 10 in. mercury boost. As shown, the power required was less when the engine was supercharged, which is due to the work of the boost pressure on the pistons during the intake stroke.

The net brake horsepower and specific fuel consumption for the engine at maximum-power air-fuel ratio and spark advance for each of the tests are shown by Fig. 5. The 5.55 compression-ratio engine, supercharged, showed an increase of 80 per cent in power output over the unsupercharged engine. The 4.25 compression - ratio engine, supercharged, showed an increase of 50 per cent in power output over the standard engine unsupercharged.

The fuel consumption curves probably show a fairly accurate picture of what may be expected in the way of economy as a result of supercharging. In the lower speed ranges, the specific fuel consumption of the engine with 5.55 compression ratio, supercharged, was practically the same as that of the engine unsupercharged, but at the higher speeds, the supercharged engine was decidedly the better. As might be expected, the specific fuel consumption of the engine with lower compression ratio, supercharged, was higher than either of the other two.

The efficiency of a theoretical Otto air cycle is independent of charge density and of the amount of heat supplied. It would therefore be expected that the specific fuel consumption of such an engine at any given speed would be the same for all manifold pressures. Fig. 6 shows curves of speed vs. indicated horse power (b.hp. + friction hp.) for the engine, unsupercharged and with a boost of 10 in. of mercury. It also shows curves of engine speed vs. specific fuel consumption, and it is interesting to note that there is no significant difference between the specific fuel consumptions with the two manifold pressures; however, the data show lower net brake specific fuel consumption for the supercharged engine at the higher speed, which is of primary importance from the practical standpoint.

Results obtained by the author indicate that it is possible to predict with a fair degree of accuracy the per cent increase in net power of a given unsupercharged engine due to supercharging by a directly-driven blower by combining separate theoretical calculations for the engine and blower. The greatest uncertainty lies in the possibility of losing fresh charge through the exhaust port due to valve overlap, which results in an increase in the power required to drive the supercharger without a corresponding increase in engine power.

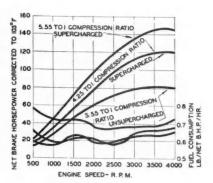


Fig. 5—Net brake horsepower and fuel consumption of 233cu. in. engine under different conditions

The percentages of the heat supplied which were converted into mechanical work, absorbed by the cooling water, and dissipated in the exhaust are shown on Fig. 7 and 8. The thermal efficiency was nearly constant over the entire range of intake manifold pressures. The percent of heat absorbed by the cooling water in general gradually decreased with a corresponding increase in percent heat lost in the exhaust gases as the manifold pressure was increased.

These data provide some further

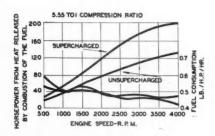


Fig. 6—Measured brake horsepower output plus horsepower required to motor engine

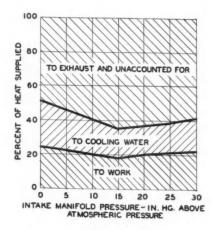


Fig. 7 — Effect of manifold pressure on heat balance of 233 cu. in. engine at 1000 r.p.m. and, 5.55 compression ratio

indication that supercharging tends to blow fresh charge through the cylinder during the period of valve overlap.

Octane-number requirements increase with the temperature at which the air enters the carburetor and with the boost pressure. With the 5.55 compression ratio at 1000 r.p.m. and 80 deg. Fahr. carburetor-inlet

temperature, they rose from 78-80 at 29 in. of mercury absolute intakemanifold pressure to 90-91 at 39 in. mercury; at 120 deg. Fahr. it rose from 77-79 at 29 in. mercury to 87-89 at 36 in. mercury, and at 170 deg. Fahr. it rose from 80-81 at 29 in. mercury to 86-87 at 34 in. mercury. With the 4.5 compression ratio the octane number requirement rose from 66-68 at 34 in. mercury to 86-87 at 48 in. mercury absolute.

As to the effect of supercharging on engine parts, the author said no commercial automotive spark plug tried operated satisfactorily over the entire speed range at a boost of 10 in. of mercury, but he believed a satisfactory plug could be developed; the time between grindings of the chrome nickel-steel intake valves was the same whether the engine was supercharged or not, but considerable difficulty was experienced with the exhaust valves. Valves of Silcrome No. 1 were definitely unsatisfactory at 10 in. mercury boost and speeds of more than 2000 r.p.m. Valves of S.A.E. No. 2112 were only slightly better. The best service was obtained from Stellite-faced valves. Even these were not entirely satisfactory, but the author pointed out

in this connection that dynamometer service of the type to which the engine was subjected is much harder on exhaust valves than even the most severe road operation, hence the exhaust-valve problem may not be as difficult as it may seem. All of the engine bearings, including babbitt-lined rod bearings, were entirely satisfactory when operating at 10 in. mercury boost.

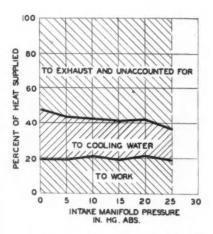


Fig. 8 — Effect of manifold pressure on heat balance of 233 cu. in. engine at 1000 r.p.m. and 4.25 compression

New Developments in Automotive Materials

(Continued from page 545)

is still necessary to use rather large amounts of the ordinary softeners or plasticizers to effect a reduction in hardness, often with sacrifice in physical and chemical properties of the product.

d

Adoption of the latest developments in accelerators has resulted in shorter cures. Many accelerators are satisfactory in extruded stocks at low tubing speeds but will scorch at high speeds. What seems to be needed is an accelerator that is safe to handle at high speeds and yet will cure rapidly to avoid collapse in open steam.

Antioxidants cause staining and discoloration so the aging of many products cannot be improved by their use. Antioxidants have improved the heat and flexing resistance of the use of rubber products.

Compounding ingredients such as carbon black, soft blacks, zinc oxide clay, whiting, blanc fixe, barytes, magnesium carbonate, asbestine, etc.,

present individual dispersion problems and affect the smoothness and processing of rubber compounds. The elimination of foreign matter and of the coarser particles would improve the physical properties and also result in better processing of the com-According to Mr. Winkelmann the trend seems to be toward low gravity fillers and this has been made possible through the development of the soft blacks. However, as the author of the paper pointed out, even in the soft blacks there is a difference in the speed with which they can be incorporated into rub-There is said to be a definite field for a natural or synthetic low gravity filler.

The surface finish of an extruded article is dependent upon the compound; of a molded article on the compound, mold and mold lubricant. More and more attention is being focused on the appearance of the rubber products, even to the adoption

of lacquers to provide a clean, glossy surface. The rubber industry is still looking for a mold lubricant which will not be absorbed by the rubber, which will adhere to the mold so the film will not be disturbed during the flow of the stock and which will not accumulate in the mold. Lacquer coatings with fair adhesion are used on rubber products, not only to improve the appearance of the rubber, but also to provide a protective coating.

It has been necessary to develop compounds in each hardness range that will not stain automobile lacquers. Contact and drip staining are two problems confronting the automotive engineer, and considerable care must be exercised in the choice of compounding ingredients, particularly accelerators, antioxidants, softeners and reclaims to minimize staining of the lacquer.

Limitations of natural rubber has led to the adoption of Neoprene and ozone resistance are required. Thiokol is used where oil, ozone and acid resistance are desired.

In his concluding remarks the author mentioned that as experience with service life tests is built up on rubber products, it may be possible for the automotive engineers to ease up on certain portions of the present specifications and substitute a service specification. The result should be a saving in product costs. He also said that it is felt that more consideration and study should be given to

where increased oil, heat, sunlight, the instruments used in judging whether rubber products meet specifications or not.

To Revise Standards for Light Alloys

A revision of the composition of aluminum-base alloys in ingot form for permanent-mold castings, as well as of those of aluminum-base alloy for permanent-mold castings, is being planned by Committee B-7, on Light Metals and Alloys, of the A.S.T.M. Changes have been de-

veloped also in the specifications of many magnesium alloys; some of the older specifications are to be withdrawn and new ones added. latter include magnesium alloy No. 16, which is said to be the best magnesium hammer-forging alloy, with physical properties about the same as those of the present alloy No. 6, but with distinctly better saltwater-corrosion resistance.

Another proposed new addition to the list of magnesium-alloy specifications is No. 15, for bars, rods, and shapes, which is said to possess excellent physical properties and saltwater-corrosion resistance: it can be heat-treated and aged.

Work is underway by this committee on anodic oxidation of aluminum and aluminum alloys, and new methods of testing anodized aluminum for dielectric strength have been proposed. Abrasion tests of anodized coatings are also being studied.

Stop this man

FROM A COMPENSATION CLAIM



This man is in danger. He is in contact with cutting oils. Dangerous pus-forming germs-germs which enter cuts and scratches on arms and hands, lurk in cutting oils. Quickly pimples and boils appear, demanding medical care. Thus another worker goes home, laid up with oil dermatitis. And another claim for compensation must be paid.

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How can you stop paying for losses that are costing plant owners and insurance companies millions of dollars each year? Very simply. Just sterilize all cutting lubricants with Derma-San. One pint of Derma-San added to 35 gallons of cutting lubricant kills oil dermatitis germs before they reach your workers.

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Thousands of plants use Derma-San because they cannot afford to be without it. They know that using Derma-San is a safety measure that promises genuine protection. Used in your plant, it will save you money. It will help keep your workers on the job . . . bring increased efficiency. It may also bring reduced insurance premiums. You need Derma-San protection now. Order a drum - today.

CHILTON ROUND TABLE

(Continued from page 538)

have been sold by recognized dealers. It seems that a purchaser of an approved used car is entitled to take out a coverage policy for a period of six months at an approximate cost of \$10 for cars not exceeding three years old and a slightly higher rate for older cars. Under the terms of the policy the company pays for any damage to the insured car arising through mechanical or electrical failure or breakage. New parts and labor charges and towing are included. The object of the whole thing being the stimulation of the sale of used cars through increased confidence of the buying public."

From Motor Age

"An abandoned Roosevelt Raceway awaits a promoter to stage its George Vanderbilt Cup classic. While the nation's headline drivers continued their plans to meet foreign competition on the twisting raceway course, backers of the Vanderbilt cup classic made frantic efforts to forestall the track's doom. No announcement of the situation was made to the fraternity pending removal of the final ray of hope.

"If current plans for a race there fail to materialize, the speed kings must be content with a lone major classic, the International 500-Mile Sweepstakes on the Indianapolis Speedway, May 30."

Nickel—A Versatile Automotive Metal

(Continued from page 545)

ing. These drums had high wear resistance and resisted deterioration under elevated-temperature conditions.

The latest design of Mack castiron brake drum is made of a nickel-chromium alloy cast iron for which it is claimed that it will stand up satisfactorily, without scoring, under service conditions which entail repeated stops from 80 m.p.h. at 16 ft. per sec. per sec. In a test, 200 stops were made from 80 m.p.h., and 16,000 from 50 m.p.h.; the resulting

deflected, and if its proportional limit is exceeded, it may take a permanent set, which will change the action of the thermostat.

Nickel-chromium iron used for the high-expansion side of thermostatic bimetals usually contains about 22 per cent nickel and 3 to 8 per cent chromium. On Invar type alloy having a higher nickel content (up to 42 per cent) is sometimes used on the low-expansion side particularly in cases where the thermostat must

be sensitive to temperature changes at relatively high temperature levels. For instance, the expansion of Invarincreases rapidly above 400 deg. Fahr. With 42 per cent nickel iron on the low-expansion side, some sensitivity in the low-temperature range is sacrificed.

Another special high nickel alloy is "Alnico," a nickel-cobalt-aluminum iron alloy for permanent magnets. It is used, for example, in the rotors of a magneto recently developed by the Edison-Splitdorf Corp. This and similar alloys have greater



Nickel cast iron piston for Pontiac engine

wear on the drum was only 0.002 in., and there was no scoring, despite the fact that drums reached temperatures in excess of 800 deg. Fahr.

Nickel-chromium irons also play an important role in marine engines, where they are used especially for cylinders, heads, manifolds, timing gears, and crankcases. The Universal Motor Co. reports that it has experienced no difficulty from valve-seat failure since adopting nickel-alloy irons. Another factor of importance in marine-engine applications is the greater resistance to salt-water corrosion of the nickel alloy cast irons, where salt water is used for engine cooling.

Nickel Iron Alloys

Nickel-iron alloys are largely used in thermostatic metals. The bimetallic strip now generally has Invartype on the low-expansion side. While brass is sometimes used on the high-expansion side, with Invar on the low-expansion side, the use of a nickel-chromium iron on the high-expansion side is increasing, because brass is not sufficiently strong for the purpose. In service, the metal strip is



Baseball players know about grain flow. They hold the edge of the grain to meet the impact of the ball... For as definite a reason, Atlas Drop Forge men perform many scientific tests to be sure that grain formation in all Atlas Forgings is best disposed to resist shock and strains and stress from every side.



ATLAS DROP FORGE CO., LANSING, MICH.



magnetic strength than other permanent magnet material now available, and their use permits a reduction in the size of magnets.

High-Content Nickel Alloys

Monel, an alloy of 70 per cent nickel and 30 per cent copper, and Inconel, an alloy containing about 80 per cent nickel, are the principal high-nickel-content special alloys. Their chief advantages are their ability to take an attractive finish, their resistance to corrosion and their ability to withstand high temperatures. Among many other applications Monel has found its way into automobile car heaters. In heaters made by Stewart-Warner, a mixture of gasoline and air is burned in the combustion chamber after being diffused by a Monel baffle. Monel is also used in aircraft devices, one application being in the fuel-level signal made by The Steel Products Engineering Co. This device automatically warns the pilot of any interruption in the flow of fuel from tank to pump. Monel is used in this unit for all parts that are subject to corrosive influences, such as studs, float guide, and needle valve.

Inconel has been used rather extensively on aircraft. One interesting application is to the exhaust collector on Douglas airliners, which serves the additional purpose of a heater for the carburetor air intake. Material for this unit must be both strong and ductile, and it must retain these properties at high temperatures; resistance to the corrosive influence of combustion gases, to rapid temperature changes, and to atmospheric corrosion is also required.

Nickel Plating

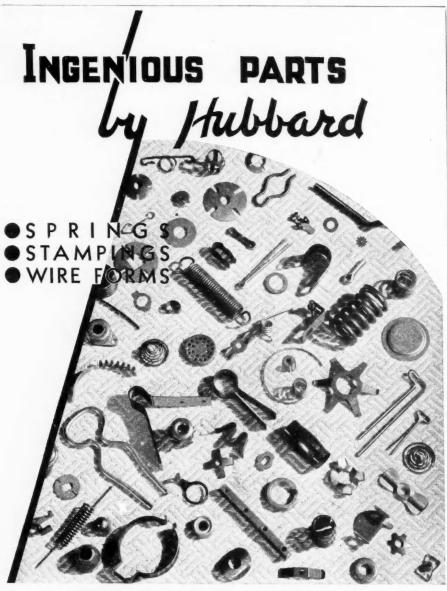
Nickel under coatings are applied to nearly 100 per cent of the automotive parts which are finished by chromium plating. Their function is to inhibit corrosion, while that of the chromium coating is to give a hard, non-tarnishing surface finish. The physical properties of nickel now used for plating are comparable with those of pure rolled nickel. Strength, density, and ductility are virtually the same.

In plating for inside service, the initial layer of nickel is made approximately 0.0005 in. thick, and this coating is covered by a 0.00002 in. deposit of chromium. For outside service a coating of nickel 0.001 in. thick is deposited and then a 0.00002 in. coating of chromium completes the job. About 10 years ago nickel coatings sometimes were made only one-tenth as thick as those now in use. There now is a tendency to use thicker coatings, and it is said that the thicknesses of the nickel coating may be increased to 0.0015 in.

Recent advances include the development of fast-plating, automatic machinery and the introduction of bright plating. It is now possible to plate strip steel from which highfinish parts may be fabricated directly. Artillery wheels, which would be very difficult to buff in the fabricated state, can be made from the plated strip. The buffing is the most important cost item in nickel plating, its cost exceeding that of the material and also that of the process of deposition. Bright plating is claimed to reduce the buffing cost by as much as 25 per cent. The process of bright plating is one in which a plate may be deposited on a highfinish surface in such manner that any existing polish is not diminished.

Cleaning of the metal surface before the nickel is deposited on it is a phase of the process which has been immensely improved, and it is feasible to deposit nickel directly on the base metal. Copper is still used as a base for nickel in several applications, one of which is the nickel plat-

ing of zinc die castings.

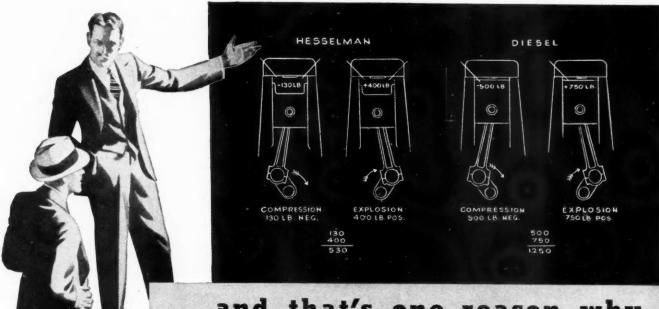


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...and that's one reason why HESSELMAN ENGINES COST LESS IN THE LONG RUN

It's a question of pressures and internal shock! It takes a lot of seven-cent gallons of fuel saved to pay for the added upkeep of a compression ignition, high pressure engine.

In a Hesselman, the compression is only 130 lb., about one-fourth the pressure needed if it were not for the spark plug ignition. And the Hesselman's explosion pressure of 400 lb. is not even as high as the compression pressure in a Diesel.

In a Diesel the total instantaneous reversal stress at top dead center—the torsional whip crack—in the crankshaft is as high as 1250 lb....more than twice that of the Hesselman's 530 lb. Just picture the timing gears as the lash of such a whip.

Because this high reversal stress comes with great suddenness, Diesel crankshafts must be much heavier to withstand torsional fatigue; bearings must be larger to withstand the pressures; gears must be stronger to prevent breakage. Besides, the heavy flywheels that smooth out these torque reversals impose further torsional strain upon the crankshaft, add to inertia, and ruin acceleration.

Hesselman Engines have none of the Diesel's high pressure disadvantages. They use positively timed electric ignition; they start in any weather promptly and easily; they cost little to maintain; they burn standard diesel fuels; they perform with the snap and ginger of a good gasoline engine. Write for Bulletin 1011—a simple explanation of all Hesselman advantages.

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WAUKESHA HESSELMAN ENGINES

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